

CHAPTER 5

LOGISTICS—SUPPLY

Section I. GENERAL

5.1. Use of Logistical Data

The logistical data contained in this and the succeeding four chapters (Logistics—Evacuation and Hospitalization; Logistics—Transportation; Logistics—Service; Logistics—Management) are of the type suitable for first approximation planning. They are, in the most part, based on World War II and Korean experience, modified to reflect changes in concept and organization. Detailed logistical planning should be based upon the references listed in the foreword.

5.2. General Supply Factors

a. The following broad general factors are useful for very long-range planning where the figures in the remainder of this chapter are too detailed. They should be used only in forming rough estimates in logistical planning or as “rule of thumb” checks against the calculations of technical planners. The overall theater factors given below include only military requirements and are based on the following ratios between ground and air: For each division slice of approximately 40,000 men, there will be 2 air-wing slices of 5,000 men each (par. 5.47a).

b. Initial Equipment and Initial 30 Days of Maintenance.¹

1	1	2	3	4	5	6	7	8	9
	Item	Total requirement per man in the theater (Army plus Air) ¹			Shipped from ZI ²			Procured in theater of operations ²	
		Meas tons per man	Short tons per man	Long tons per man	Meas tons per man	Short tons per man	Long tons per man	Short tons per man	Long tons per man
2	Initial equipment.....	4.0	1.50	1.33	4.0	1.50	1.33	-----	-----
3	30 days' maintenance:								
4	Dry cargo.....	1.0	.68	.60	.8	.54	.48	.14	.12
4	Bulk POL.....	3.43	.30	.26	3.43	.3	.26	0.	0.
5	Total.....	5.43	2.48	2.19	5.23	2.34	2.07	.14	.12

¹For use as broad initial planning factors. Does not include tonnages involved in buildup of theater reserves.

²Applicable only in situations when procurement in the theater of operations is feasible.

³Bulk petroleum normally is not expressed in measurement tons. This figure is provided in this table merely for the purpose of comparison with dry cargo.

Section II. CLASS I SUPPLY

5.3. Characteristics of Standard Rations

	1	2	3	4	5	6
	Type ration	Packaging information			Average weight per ration, including packing (lb)	Remarks
1		Number rations per package (case)	Weight per package (lb) (case)	Volume per package (cu. ft.) (case)		
2	Field A.-----				6.0	This is the basic field ration. It consists of approximately 200 items, including such perishables as fresh and frozen meats, vegetables, and fruit. It is intended for use primarily under stable conditions and during static phases of military operations when normal cooking and refrigeration facilities are available. It should be issued in preference to any other type of ration whenever it is available and circumstances permit its use (0.183 cu ft per ration).
3	Operational B.-----				6.0	Same as the field ration, with nonperishables substituted for perishables (0.1269 cu ft per ration).
4	Small detachment, 5 persons.	5 rations	28.5	1.1	5.8	Consists of nonperishable precooked food which is designed to be eaten hot. Five separate menus.
5	Combat, individual, Type C.	6 rations	38	1.2	6.5	Nonperishable precooked food which may be eaten hot or cold; it is carried and prepared by the individual soldier. Six separate menus.
6	Ration, individual, combat, meal type.	4 packets (12 meals)	24	.85	4.8	Designed for use as individual meal packets or in multiples of 3 for a complete ration. Not to be used over extended periods.
7	Trail, frigid, individual.	8 rations	34	1.6	4.0	Designed for use in extremely cold climates by small patrols or trail teams under conditions where resupply is impossible.
8	Ration supplement, spice pack.	-----	20	0.8	-----	Provides spices, condiments, and leavening agents to supplement 1,000 operational rations B.
9	Ration supplement, sundries pack (1 pack per 100 men).	-----	47	1.9	-----	Provides comfort items such as toilet articles, tobacco, and candy, serving as a supplement to operational ration B, for the health and comfort of the troops.
10	Ration supplement, aid station (makes 205 8-oz drinks).	-----	20	1.1	-----	Designed to provide special nourishment in the form of hot stimulating beverages for combat zone casualties at aid and clearing stations.
11	Food packet, assault, individual.	24 packets	29	1.1	1.1	Is packaged so that it may be carried by the individual; it is provided troops in the initial assault phase of combat, when food is required that is lightweight, highly palatable, and conveniently carried by the individual.
12	Food packet, survival, arctic, SA.	24 packets	34	0.7	1.5	May be issued as an item of personal equipment. To be used for survival episodes only, packet contains food for 1 man for 1 day for survival in a cold environment.
13	Food packet, survival, ST.	24 packets	36	0.7	1.5	Designed to be carried exclusively in survival kits of aircraft operating over tropical regions; contains food for 1 man for 3 days or 3 men for 1 day in a tropical climate.

5.4. Time Elements in Class I Supply

While the figures shown in this table are an approximate *average* for combat conditions,

they should be used only as a guide when actual experience is lacking.

	1	2	3
	Work	Daylight (min)	Dark (min)
1			
2	Unload rations for one division at class I distributing point and prepare for distribution to battle groups or battalions.	120	150
3	Distribution of class I supplies to battle group or similar size unit by higher echelon at one distributing point.	30	30
4	Distribution of class I supplies to separate battalion by higher echelon or similar unit.....	15	15
5	Preparation of 1 day's class I supplies for issue at battle group or battalion class I distributing point.	30	60
6	Physical distribution by battle group supply agencies of one field ration (transfer of loads) to kitchens.	15	20
7	Kitchens to be taken off trucks, set up, and ready to begin cooking (or vice versa).....	20	20
8	Division of 1 ration into 3 meals at kitchens.....	15	20
9	Kitchens to cook and prepare for serving a hot meal, starting with a hot kitchen.....	120	150
10	Kitchens to prepare a cold noon meal. The issue of this meal to take place usually coincident with serving breakfast. (Included in item next above).	60	90
11	Serving a hot meal to troops from a kitchen truck when majority of men are served at the truck..	45	60
12	Serving a hot meal to troops by means of carrying parties (assuming the kitchen truck not farther than 1,000 yards in rear of the company).	90	120

Section III. CLASS II AND IV SUPPLY—DIMENSIONS AND WEIGHTS

5.5. Items of Chemical Equipment

	1	2 ¹	3	4	5	6	7	8	9
	Class	Type or model	Length	Width	Height	Square feet	Cubic feet	Short tons	Meas tons
			(Dimensions—in.)						
2	Truck.....	Decontaminating apparatus, power-driven, truck-mounted, M3A3.	261	87	105	158	1,380	7.1	34.5
3	-----	Service unit, flamethrower, truck-mounted, ABC-M4A1.	-----	-----	-----	-----	1,656	-----	41.4
4	-----	Service unit, flamethrower, truck-mounted, M4.	270	88	121	165	1,663	8.2	41.4
5	Shop equipment.	Maintenance and repair set, CmlC eqp, M1A1.	-----	-----	-----	-----	104	1.3	2.6
6	Laboratory.....	Lab, cml, base, M2.....	-----	-----	-----	-----	1,356	11.0	33.9
7	-----	Lab, cml, mobile, M3.....	-----	-----	-----	-----	145	1.6	3.6
8	Clothing impregnating.	Impregnating plant, clothing, M2A1	-----	-----	-----	-----	-----	50.0	-----
9	-----	Impregnating outfit, clothing, field, M3.	-----	-----	-----	-----	1.7	.027	.04
10	Gas-particulate filter unit.	Filter unit, gas-particulate, EMD or GED, 300 cfm, ABC-M6.	-----	-----	-----	9.1	37	.3	.9
11	-----	Filter unit, gas-particulate, GED, 200 cfm, M2A2.	-----	-----	-----	-----	54	.6	1.4
12	-----	Filter unit, gas-particulate, tank, 3-man, 12 cfm, M7A1.	39	15	18	5	6	.07	.14
13	-----	Filter unit, gas-particulate, tank, 3-man, 12 cfm, M8A1.	39	15	18	5	6	.07	.14
14	Smoke generator	Generator, smoke, mechanical, pulse-jet, M3A2.	51	24	29	9	20	.11	.5

See footnotes at end of table.

	1	2 ¹	3	4	5	6	7	8	9
1	Class	Type or model	Length	Width	Height	Square feet	Cubic feet	Short tons	Meas tons
			(Dimensions—in.)						
15	-----	Generator, smoke, mechanical, M2A1.	43	30	33	9	25	.16	.63
16	Compressor-----	Compressor, reciprocating, power-driven, 7 cfm, M1A1.	72	36	43	18	65	.8	1.4
17	Portable flame-thrower.	Flamethrower, portable, M2A1-7.	-----	-----	-----	-----	8.2	.056	.21
18	-----	Service kit, portable flamethrower, M2A1-7.	-----	-----	-----	-----	3.2	.041	.08
19	-----	Flamethrower, portable, M2A1-----	34	25	19	6	9.4	.055	.24
20	-----	Service kit, portable flamethrower, M2A1.	24	19	12	3.2	3.2	.041	.08
21	-----	Compressor, reciprocating, power-driven, 7 cfm, M1A1.	72	36	43	18	65	.8	1.4
22	Protective-----	Mask, protective, field, M9A1 ² ----	21	19	15	2.8	3.3	.028	.08
23	-----	Breathing apparatus, compressed air, M15.	-----	-----	-----	-----	2.2	.02	.06
24	Detection-----	Detector kit, chemical agent, M9A2 ³	22	18	10	2.7	2.3	.025	.05
25	Incendiary oil mixing.	Mixing and transfer unit, incendiary oil, M5.	111	49	53	38	108	1.1	2.7
26	Irritant gas disperser.	Irritant gas disperser, skid-mounted, GED, 5,000 cfm, M2.	69	44	49	20	84.6	.4	2.1

¹ All items crated except trucks.

² Packed 6 masks per box.

³ Packed 8 detector kits per box.

5.6. Items of Engineer Equipment^{1 2 3 4}

	1	2	3	4	5	6	7	8	9
1	Class	Type or model	Length	Width	Height	Square feet	Cubic feet	Short tons	Meas tons
			(Dimensions—in.)						
2	Construction equipment.	Air conditioner, tlr-mtd, gas-driven, 26,500 BTU per hr.	102	66	62	47	241	1.0	6.0
3	-----	Auger, earth, skid-mtd, gas-driven, model HDM-S (TM 5-9132).	133	34	60	31	157	2.6	3.9
4	-----	Compressor, air, truck-mtd, gas-driven, reciprocating compressor, 210 cfm, LeRoi model 210G1 (TM 5-5065).	275	97	98	185	1,510	8.2	37.7
5	-----	Compressor, air, tlr-mtd, diesel-driven, 315 cfm, Joy model WK-80-315.	131	80	77	73	467	2.9	12.6
6	-----	Compressor, air, rotary, whl-mtd, diesel-driven, 600 cfm.	168	72	99	84	693	5.0	17.5
7	-----	Compressor, reciprocating, trk-mtd, w/gas power unit, 80 cfm, air cooled.	261	96	111	175	1,614	11.9	40.2
8	-----	Crane, nonrevolving, tractor-operated, wheeled, 40,000-lb capacity, 20-ft boom (TM 5-9060).	344	111	270	265	5,970	4.2	149.0
9	-----	Crane-shovel, power unit, crawler-mounted, gas-driven, 10-ton, ¾ cu yd, Keohring model 304 (TM 5-1172).	178	115	121	142	1,432	18.6	35.4

See footnotes at end of table.

	1	2	3	4	5	6	7	8	9
1	Class	Type or model	Length	Width	Height	Square feet	Cubic feet	Short tons	Meas tons
			(Dimensions—in.)						
10	-----	Crane-shovel, power unit, crawler-mtd, diesel-driven, 40-ton, 2 cu yd, Lima model 802 (TM 5-9861-1).	252	137	151	241	3,040	67.7	76
11	-----	Crane-shovel, trk-mtd, gas-driven, air transportable, 2-ton, 3/8 cu yd.	370	89	91	228	1,734	7.5	43.4
12	-----	Crane-shovel, trk-mtd, gas-driven, 20-ton, 3/4 cu yd, Lorain model E-6620.	492	108	138	370	4,240	21.1	106.0
13	-----	Crusher, air transportable, jaw type, tlr-mtd, 15 TDH.	204	94	91	133	1,010	7.9	25.2
14	-----	Distributor, bituminous material, trk-mtd, 800 gal.	328	96	99	218	1,805	11.0	45.1
15	-----	Distributor, water, trk-mtd, 1,000 gal.	304	91	103	192	1,648	10.6	41.2
16	-----	Ditching machine, ladder, crawler 18-24 in. x 8 ft.	294	132	135	270	3,030	15.0	75.8
17	-----	Grader, road, mtz, 4 x 4, diesel-driven, 14,500- to 17,000-lb pull, 13 ft.	291	95	104	192	1,664	11.0	41.6
18	-----	Grader, road, mtz, diesel-driven, 7,000- to 8,975-lb pull, 10 ft, air transportable.	263	82	84	149	1,050	7.3	26.3
19	-----	Grader, road, mtz, diesel-driven, tandem, 12,500- to 14,475-lb pull, 12 ft.	300	94	91	196	1,482	11.7	37.1
20	-----	Grader, road, towed, leaning wheel, 12-ft moldboard.	382	118	96	312	2,500	6.2	62.6
21	-----	Heater, asphalt, tlr-mtd, 3-car cap, 42 hp.	190	66	79	87	573	2.5	14.3
22	-----	Kettle, asphalt, skid-mtd, gas-circulating pump, 750 gal.	152	82	53	87	384	3.3	9.6
23	-----	Lubricating and servicing unit, power-operated, tlr-mtd, storage tank, 12 cfm.	166	83	78	96	622	3.7	15.5
24	-----	Mixer, concrete, gas-driven, end discharge, tlr-mtd, 16 cu ft.	115	98	127	78	828	2.9	20.7
25	-----	Powerplant, tlr-mtd, 5 kw	144	72	72	72	432	1.5	10.8
26	-----	Pump, asphalt, tlr-mtd, with distributor attached.	120	84	86	70	501	2.1	12.5
27	-----	Pump, water, tlr-mtd, with distributor attached.	180	78	73	98	592	1.1	14.8
28	-----	Roller, road, gas-driven, 2-axle tandem, 5- to 8-ton.	177	63	86	77	555	6.6	13.9
29	-----	Roller, road, gas-driven, 3-axle tandem, 9- to 14-ton.	268	63	87	117	850	9.5	21.3
30	-----	Roller, road, gas-driven, 3-wheel, 10-ton, w/scarifier.	205	77	81	110	742	10.1	18.5
31	-----	Roller, road, towed, sheepsfoot, 2 drums in line.	175	115	58	140	676	3.0	16.9
32	-----	Roller, road, towed, sheepsfoot, 3 drums in line.	139	180	54	174	784	4.2	19.5
33	-----	Roller, road, towed, wheeled, 13 pneumatic tires.	174	89	46	108	412	1.8	10.3
34	-----	Roller, road, towed, pneumatic tires, 4 tires, 85,000-lb cap.	298	96	92	198	1,522	7.4	38.1

See footnotes at end of table.

	1	2	3	4	5	6	7	8	9
1	Class	Type or model	Length	Width	Height	Square feet	Cubic feet	Short tons	Meas tons
			(Dimensions—in.)						
35	-----	Rooter, road, cable-operated, 3-tooth, heavy.	240	98	108	163	1,470	3.8	36.8
36	-----	Scraper, road, towed, cable-operated, 8 cu yd.	355	118	120	291	2,910	7.8	72.7
37	-----	Scraper, road, towed, cable-operated, 12 cu yd.	376	137	130	357	3,880	10.2	96.9
38	-----	Searchlight, 60-in , w/power-plant and control sta, trk-mtd.	280	96	140	186	2,180	9.3	54.4
39	-----	Semitrailer, tank, steel, 1,500 gal, w/pump.	216	96	90	144	1,080	3.6	27.0
40	-----	Tank, asphalt, steel, tlr-mtd, steam coils, 1,500 gal.	234	96	109	156	1,416	5.0	35.4
41	-----	Tractor, full-tracked, diesel, 8,600-12,000 lb DBP, air transportable, phase 1, w/loader, scoop type, hydraulic-operated, 3 cu yd bucket (D-4).	174	73	72	88	528	8.3	13.2
42	-----	Tractor, full-tracked, diesel, 12,100-17,000 lb DBP, air transportable, phase 1, w/bulldozer (D-6).	190	95	73	125	764	11.4	19.1
43	-----	Tractor, full-tracked, diesel, 17,100-24,000 lb DBP, w/angledozer (D-7).	219	98	80	149	995	17.8	24.8
44	-----	Tractor, full-tracked, diesel, 24,100-32,000 lb DBP, w/angledozer (D-8).	240	104	90	174	1,300	20.0	32.5
45	-----	Tractor, wheeled, indiv, gas-driven, 5,200-7,775 lb DBP.	108	66	75	49	310	3.0	7.8
46	-----	Tractor, wheeled, diesel-driven, 14,025 to 20,000 lb DBP.	194	96	115	129	1,239	12.7	30.9
47	-----	Tractor, wheeled, diesel-driven, 20,015 to 27,000 lb DBP.	221	136	106	285	1,850	15.7	46.1
48	-----	Trailer, dump, mtz, bottom dump, 13 cu yd.	445	115	129	356	3,820	16.0	95.8
49	-----	Trailer, bolster, 2½-ton, 1 swivel bolster.	189	90	42½	118	419	1.1	10.5
50	-----	Trailer, bolster, 2½-ton, 2 stationary bolsters inf raft and/or pneumatic brg eqp.	189	90	65	118	640	1.1	16.0
51	-----	Trailer, bolster, 2½-ton, 2 stationary bolsters triangulation tower.	214	79	65	117	636	1.5	15.9
52	-----	Trailer, 2-wheel, 3-ton, ¾ cu yd, clamshell bucket.	171	108	49	128	524	1.8	13.1
53	-----	Trailer, flat-bed, 10-ton, crane-shovel attached.	333	98	60	227	1,135	5.6	28.3
54	-----	Trailer, low-bed, 8-ton, goose neck, fixed type.	288	100	55	200	918	4.8	22.9
55	-----	Trailer, low-bed, 60-ton, goose-neck, fixed type.	495	134	76	461	2,916	16.0	72.9
56	-----	Truck, bolster body, 2½-ton, 6 x 6, w/winch.	268	87	96	162	1,291	5.7	32.4
57	-----	Truck, stake, 5-ton, w/winch (mil bridging).	369	114	114	292	2,765	13.4	69.4
58	-----	Welding equipment, set No. 1, elev arc, tlr-mtd.	143	72	69	72	412	1.8	10.3

See footnotes at end of table.

	1	2	3	4	5	6	7	8	9
1	Class	Type or model	Length	Width	Height	Square feet	Cubic feet	Short tons	Meas tons
			(Dimensions—in.)						
59	Boats-----	Boat, bridge erection, gas, aluminum, 19 ft.	234	97	72	158	948	1.6	23.6
60	-----	Boat, bridge erection, gas, aluminum, 27 ft.	324	96	80	216	1,440	2.9	36.0
61	Bridges-----	Bridge, fixed, steel panel, Bailey type, M2.						125.0	175.0
62	-----	Bridge, floating, foot, aluminum						9.1	34.3
63	-----	Bridge, floating, M4						232.8	
64	-----	Bridge, floating, pneumatic, class 60, steel superstructure.						388.0	950.0
65	-----	Bridge, floating, hwy, aluminum deck balk on pneumatic floats (M4T6).						92.5	205.0
66	-----	Bridge erection set, floating brg w/aluminum deck balk superstructure.						2.0	4.4
67	Ferries-----	Construction outfit, raft, set No. 1, inf support.						4.8	20.3
68	-----	Ferry conversion set, raft, inf support.						1.5	7.8
69	Electric light-----	Light set, gen illum, set No. 3, 3 kw	90	36	38	23	71	1.0	1.8
70	-----	Light set, gen illum, set No. 4, 5 kw	120	48	56	40	187	1.5	4.7
71	-----	Light set, gen illum, set No. 5, 15 kw						5.5	23.5
72	-----	Generator set, diesel, skid-mtd, 120-208, 240-416 volts, 60 cy, 15 kw.	84	30	57	17	83	1.6	2.1
73	-----	Generator set, diesel, skid-mtd, 120-208, 240-416 volts, 60 cy, 30 kw.	108	36	69	27	156	2.5	3.9
74	-----	Generator set, diesel, skid-mtd, 120-208, 240-416 volts, 60 cy, 45 kw.	87	36	59	22	107	2.2	2.7
75	-----	Generator set, diesel, skid-mtd, 120-208, 240-416 volts, 60 cy, 60 kw.	120	36	76	30	191	2.8	4.8
76	-----	Generator set, diesel, skid-mtd, 120-208, 240-416 volts, 400 cy, 30 kw.	110	36	76	28	176	2.5	4.4
77	-----	Generator set, diesel, skid-mtd, 120-208, 240-416 volts, 400 cy, 45 kw.	87	36	59	22	107	2.2	2.7
78	Plants-----	Asphalt plant, 10 to 30 tons per hr, mixer, bituminous.	180	102	120	128	1,275	5.5	31.9
79	-----	Asphalt plant, 10 to 39 tons per hr, dryer aggregate.	246	108	127	185	1,960	6.0	48.8
80	-----	Crushing and screening plant, 50 tons per hr.	480	124	144	414	4,960	32.0	124.0
81	-----	Power plant, nuclear, fixed, 2,000 kw electrical ^{5 6}						640	
82	Fire-fighting equipment-----	Fire-fighting eqp set w/trk guided missile.	162	80	77	90	577	3.2	14.5
83	-----	Fire-fighting eqp set, w/trk, guided missile.	336	96	108	224	2,020	18.5	50.4
84	-----	Fire-fighting eqp set, w/trk, set No. 18, 500 gpm.	270	96	111	180	1,667	11.3	41.6

See footnotes at end of table.

	1	2	3	4	5	6	7	8	9
1	Class	Type or model	Length	Width	Height	Square feet	Cubic feet	Short tons	Meas tons
			(Dimensions—in.)						
85	Topographic equipment	Fire-fighting eqp set, w/trk, set No. 21, Army acft crash.	294	96	106	196	1,740	10.5	44.0
86		Photoprinting and processing topo repro set, trk-mtd, set No. 3.	327	96	132	218	2,400	12.1	60.0
87		Reproduction eqp, topo, mtz, camera sec, set No. 7.	327	96	132	218	2,400	12.5	60.0
88		Reproduction eqp, topo, mtz, laboratory sec, set No. 3.	327	96	132	218	2,400	10.6	60.0
89		Reproduction eqp, topo, mtz, map layout sec, set No. 2.	327	96	132	218	2,400	10.7	60.0
90		Reproduction eqp, topo, mtz, plate grainer sec, set No. 3.	327	96	132	218	2,400	12.5	60.0
91		Reproduction eqp, topo, mtz, plate process sec, set No. 3.	327	96	132	218	2,400	11.0	60.0
92		Reproduction eqp, topo, mtz, press sec, set No. 7.	327	96	132	218	2,400	12.5	60.0
93	Shop equipment	Photomapping eqp, set No. 1, topo bn, army.						10.8	44.4
94		Photomapping eqp, set No. 3, topo co, corps.						2.5	6.5
95		Map distribution eqp, set No. 1						2.2	5.8
96		Tower erection set, topo, w/tower						7.5	11.4
97		Shop eqp, org repair, light, trk-mtd, set No. 2.	318	94	129	208	2,228	11.0	55.8
98		Shop eqp, contact maint, trk-mtd, set No. 3.	214	83	89	123	914	2.5	22.9
99		Shop eqp, electrical repair, semitr-mtd, set No. 4.	324	97	129	218	2,342	11.8	58.7
100		Shop eqp, gen purpose, heavy, semitr-mtd, set No. 1	307	96	112	204	1,905	11.3	47.8
101	Water purification	Shop eqp, set No. 8, welding	80	42	41	23	80	3.9	2.0
102		Woodworking shop eqp, base maint, set No. 1.	145	72	46	72	278	1.9	6.9
103		Water purification eqp, diatomite, set No. 3, portable, 35 gpm.	171	75	67	89	498	3.6	12.3
104		Water purification eqp, diatomite, set No. 4, portable, 50 gpm.	24	24	48	4	16	2.9	.4
105	Miscellaneous	Fire and salvage eqp, marine, set No. 1.						22.7	65.8
106		Intrenching eqp, set No. 2						2.3	6.3
107		Pneumatic tools, set No. 1, 315 cfm						1.2	3.2
108		Quarry eqp, set No. 1, 50 tons per hr.	444	108	72	333	2,000	7.4	50.0

¹ Items exceeding 1 short ton, uncrated.

² Dimensions shown in columns 3, 4, and 5 are the maximum length, width, and height in inches of fully assembled equipment in travel position.

³ Weights of vehicles shown in column 8 are for vehicles not loaded.

⁴ Measurement tons represent the volume of the fully assembled item; i.e., the product of columns 3, 4, and 5 in cubic feet divided by 40.

⁵ Capacity can be divided between electric power and heat; i.e., 1,300 kw electrical plus 3,500 kw equivalent of heat.

⁶ Essential power plant components and building can be transported in 46 C-124 aircraft (2,100 miles range). The following materials are assumed to be available at the site—foundation materials, concrete aggregate, and earth suitable for shielding.

5.7. Major Medical Service Units Assemblies

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	Cons comb and TOE number	Type of assembly and stock number	Medical equipment						TOE equipment						Total medical and TOE equipment					
			No. of lines	No. of pack- ages	Weight	Cube	Car- loads	Sq ft of storage space	No. of lines	No. of pack- ages	Weight	Cube	Car- loads	Sq ft of storage space	Total No. of lines	Total No. of pack- ages	Total weight	Total cube	Total car- loads	Total sq ft of storage space
2	SGN----- 8-581R-----	Evac hosp, smbl (400-bed)----- 6545-919-5800 (9-195-800)	3,065	1,045	83,655	5,189	2	700	249	1,052	144,352	8,221	3	1,040	3,314	2,097	228,007	13,410	5	1,740
3	SGM----- 8-510R-----	Field hosp (400-bed)----- 6545-919-6450 (9-196-450)	4,048	1,170	107,638	7,006	3	800	549	956	113,844	5,721	3	700	4,597	2,126	221,482	12,727	6	1,500
4	SGG----- 8-561R-----	Sta hosp, comz (25-bed)----- 6545-955-1800 (9-551-800)	1,159	243	23,074	1,489	1	190	377	216	25,805	1,459	1	180	1,536	459	48,879	2,948	2	370
5	SGF ¹ ----- 8-562R-----	Sta hosp, comz (50-bed)----- 6545-955-1810 (9-551-810)	1,463	289	28,905	1,967	1	250	315	277	33,598	2,072	1	250	1,778	566	62,503	4,039	2	500
6	SGE ¹ ----- 8-563R-----	Sta hosp, comz (100-bed)----- 6545-955-1830 (9-551-830)	1,735	462	64,291	4,300	2	490	338	397	45,699	3,023	1	358	2,073	859	109,990	7,323	3	848
7	SG3/ ¹ ----- None	Sta hosp, comz (200-bed)----- None	1,950	790	93,180	6,401	3	760	235	810	51,743	3,328	1	400	2,185	1,600	144,923	9,729	4	1,160
8	SGD----- 8-565R-----	Sta hosp, comz (250-bed)----- 6545-955-1850 (9-551-850)	2,176	974	104,980	7,445	3	900	307	791	84,930	5,844	2	740	2,483	1,765	189,910	13,289	5	1,640
9	SG4----- 8-565R-----	Sta hosp, comz (300-bed)----- 6545-955-1850 (9-551-850)	2,746	1,106	120,211	8,514	4	1,100	290	387	91,924	6,502	2	800	3,036	1,493	212,135	15,016	6	1,900
10	SGC----- 8-566R-----	Sta hosp, comz (500-bed)----- 6545-955-1880 (9-551-880)	2,563	1,824	193,243	14,042	6	1,895	483	1,282	199,271	12,185	6	1,660	3,046	3,106	393,013	26,227	12	3,555
11	SGB----- 8-567R-----	Sta hosp, comz (750-bed)----- 6545-955-1910 (9-551-910)	2,702	2,267	255,581	18,911	9	2,400	512	1,852	221,177	12,803	6	1,750	3,214	4,119	476,758	31,714	15	4,150
12	SGA ¹ ----- 8-551R-----	Gen hosp, comz (1,000-bed)----- 6545-925-3950 (9-253-950)	2,825	3,465	407,171	30,843	13	3,785	335	2,105	250,003	13,638	6	1,800	3,160	5,570	657,174	44,481	19	5,585
13	SHB ¹ ----- 8-590R-----	Conv cen, army (1,500 patients)----- 6545-914-4295 (9-144-295)	1,117	945	84,097	5,516	2	720	170	2,706	276,508	12,612	6	1,500	1,287	3,651	360,605	18,128	8	2,220
14	SGQ ¹ ----- 8-590R-----	Conv cen, army (1,500 patients)----- 6545-914-4285 (9-144-295)	1,405	1,100	120,000	8,700	3	1,050	495	4,400	520,000	31,400	13	4,000	1,900	5,500	640,000	40,100	16	5,050
15	SGT----- 8-500R----- (Team MA)	Gen disp, type I----- 6545-925-2700 (9-252-700)	552	101	8,942	447	LCL	56	233	51	4,062	218	LCL	27	785	152	13,004	665	LCL	83
16	SGT ¹ ----- 8-500R----- (Team MB)	Gen disp, type II----- 6545-925-2800 (9-252-800)	551	85	6,450	350	LCL	34	84	45	4,050	90	LCL	11	635	130	10,500	440	LCL	45
17	SGR ¹ ----- 8-650C-----	Med gen lab, comz----- 6545-925-9740 (9-259-740)	1,405	626	37,500	4,100	1	500	126	85	13,000	900	1	110	1,531	711	50,500	5,000	2	610
18	SGS----- 8-640C-----	Med lab, army----- 6545-925-9760 (9-259-760)	1,422	526	78,027	8,472	4	750	128	125	19,042	1,066	1	140	1,550	651	97,069	9,538	5	890

¹ Estimate.

5.8. Items of Ordnance Equipment^{1 2}

a. Amphibious Vehicles.

	1	2	3	4	5	6	7	8	9
1	Class	Type or model	Length	Width	Height	Square feet	Cubic feet	Short tons	Meas tons
			(Dimensions—in.)						
2	Truck-----	Landing vehicle, wheeled, 2½-ton 6 x 6.	372	99	*106	256	2,020	7.4	55.9
3	Landing vehicle--	MK 4, LVT (4), unarmored-----	314	128	99	279	2,302	13.7	71.5
4	Carrier-----	Cargo, M29C, amph-----	192	67	71	90	531	3.0	13.2

* Reducible to 90 inches.

b. Ground Combat Vehicles.

	1	2	3	4	5	6	7	8	9
1	Class	Type or model	Length	Width	Height	Square feet	Cubic feet	Short tons	Meas tons
			(Dimensions—in.)						
2	Carrier-----	Cargo, M29-----	126	66	71	58	342	2.3	8.5
3	Carrier-----	Carrier, personnel, full-tracked, armored, M75.	209	108	95	157	1,245	14.3	30.6
4	Carrier-----	Carrier, personnel, full-tracked, armored, M59.	215	129	88	198	1,451	19.4	36.3
5	Carrier-----	Cargo, amph, M76 (T46E1)-----	215	98	103	146	1,257	4.4	31.4
6	Gun-----	SP, half-track, M16 series-----	257	85	103	152	1,305	9.3	32.0
7	Mortar-----	SP, half-track, 81-mm, M21-----	249	88	87	152	1,105	7.8	27.4
8	Gun-----	SP, full-track, twin, 40-mm, M19A1	218	115	117	170	1,682	18.5	39.5
9	Gun-----	SP, full-track, twin, 40-mm, M42, M42A1.	244	129	111	218	2,021	21.5	47.5
10	Gun, carriage, motor.	SP, full-track, 90-mm, M56-----	242	98	87	165	1,194	7.9	29.9
11	Howitzer-----	SP, full-track, 105-mm, M37, M7B1, M7B2.	216	118	112	177	1,650	23.0	39.0
12	Howitzer-----	SP, full-track, 105-mm, M52, M52A1.	215	128	134	191	2,140	25.0	53.6
13	Howitzer-----	SP, full-track, 8-in., M43-----	289	124	130	249	2,699	40.0	67.2
14	Howitzer-----	SP, full-track, 8-in., M55-----	325	140	140	316	3,698	45.0	92.7
15	Gun-----	SP, full-track, 155-mm, M53-----	402	140	140	392	4,570	46.0	114.6
16	Howitzer-----	SP, full-track, 155-mm, M44, M44A1.	240	128	122	214	2,165	31.0	54.6
17	Howitzer-----	SP, full-track, 155-mm, M41-----	230	112	96	179	1,432	21.5	38.2
18	Tractor-----	Truck, gun-lifting, heavy, 4 x 4, front, M249 (transports 280-mm gun).	368	124	120	317	3,170	15.0	79.1
19	Tractor-----	Truck, gun-lifting, heavy, 4 x 4, rear, M250 (transports 280-mm gun).	369	124	120	318	3,180	14.5	79.3
20	Tank-----	Combat, full-track, medium, 90-mm gun, M47.	276	138	117	264	2,580	48.6	69.0
21	Tank-----	Combat, full-track, medium, 90-mm gun, M48, M48A1, M48A2, M48C.	289	146	115	293	2,808	49.5	68.4
22	Tank-----	Combat, full-track, heavy, 120-mm gun, M103	397.5	146	127	405	4,290	62.8	104.0

¹ Items exceeding 1 short ton, uncrated.

² Weights shown in column 8 for combat vehicles, except half-tracks, are fighting (loaded) weights. Those for half-tracks and noncombat vehicles are weights of vehicles not loaded.

	1	2	3	4	5	6	7	8	9
			Length	Width	Height	Square feet	Cubic feet	Short tons	Meas tons
1	Class	Type or model	(Dimensions—in.)						
23	Tank-----	Combat, full-track, light, 76-mm gun, M41, M41A1, M41A2, M41A3.	264	130	111	238	2,205	25.4	56.9
24	Semitrailer-----	Tank, transporter, 50-ton, 8-wheel, M15A2.	(*)	(*)	(*)	(*)	(*)	(*)	(*)
25	Truck-----	Tractor, 10-ton, 6 x 6, M123 (tows semitrailer, M15A1).	280	114	112	221.6	2,068	14.17	51.7
26	Vehicle-----	Tank, recovery, heavy, M51-----	399	143	129	396	4,260	60.0	106.45
27	Vehicle-----	Tank, recovery, medium, M74-----	330	122	133	279	3,100	46.8	76.96
28	Launcher-----	Launcher, rocket, 762-mm, trk-mtd.	508	120	124	423.3	5,012	20.9	125.3
29	Trailer-----	Trailer, rocket, 762-mm-----	301	96	78	200.7	2,669	2.2	66.7

* Data not available.

c. Tractors (less those peculiar to other technical services).

	1	2	3	4	5	6	7	8	9
			Length	Width	Height	Square feet	Cubic feet	Short tons	Meas tons
1	Class	Type or model	(Dimensions—in.)						
2	High speed-----	13-ton, M5-----	191	100	104	133	1,151	14.3	28.8
		13-ton, M5A1-----	197	100	123	137	1,403	15.2	28.8
		13-ton, M5A2-----	191	115	104	152	1,323	13.1	28.8
		13-ton, M5A3, M5A4-----	197	115	105	157	1,379	15.2	28.8
3	High speed-----	18-ton, M4, M4C, M4A1, M4A1C.	203	97	99	137	1,129	15.7	28.2
4	High speed-----	38-ton, M6 (hv)-----	258	121	104	217	1,882	38.0	45.5
5	High speed-----	Cargo, M8E2, w/M5 bulldozer-----	301	131	120	274	2,741	30.8	68.4
6	High speed-----	Cargo, M8E2-----	265	131	120	242	2,418	27.5	60.3

d. Truck Tractors.

	1	2	3	4	5	6	7	8	9
			Length	Width	Height	Square feet	Cubic feet	Short tons	Meas tons
1	Class	Type or model	(Dimensions—in.)						
2	1½-ton-----	Truck, 4 x 2-----	202	86	84	120	845	2.9	21.2
3	2½-ton-----	Truck, 6 x 6, M48-----	240	93	82	155	1,060	5.7	28.0
4	5-ton-----	Truck, 6 x 6, M52-----	257	97	102	173	1,471	9.2	36.8
5	10-ton-----	Truck tractor, 6 x 4-----	257	96	100	171	1,712	7.6	-----

e. Trucks.

	1	2	3	4	5	6	7	8	9
	Class	Type or model	Length	Width	Height	Square feet	Cubic feet	Short tons	Meas tons
			(Dimensions—in.)						
2	¼-ton	4 x 4, utility, M38A1	139	61	57	60	274	1.3	6.6
3	½-ton	4 x 4, carrier, lt wpn, inf, M274	104	47	28	32	72	3.5	2.0
4	¾-ton	4 x 4, ambulance, M43	198	74	92	102	782	3.6	19.7
5	¾-ton	4 x 4, cargo, M37	189	74	90	97	728	3.0	18.4
6	2½-ton	6 x 6, cargo, LWB, M35	261	96	111	174	1,610	6.3	45.3
7	2½-ton	6 x 6, cargo, M36C	323	96	125	215	2,241	6.8	56.0
8	2½-ton	Watertank, 1,000 gal	262	95	92	173	1,325	6.6	33.2
9	2½-ton	Gasoline tank, 1,200 gal	262	95	92	173	1,325	6.9	33.2
10	2½-ton	6 x 6, dump, M47	236	96	108	157	1,420	7.3	35.5
11	5-ton	6 x 6, cargo, M41	294	97	111	198	1,830	9.9	46.1
12	5-ton	6 x 6, wrecker	348	97	106	234	2,079	16.8	51.7
13	7½-ton	6 x 6, prime mover	297	103	125	213	2,219	14.6	55.5

f. Miscellaneous Motor Vehicles.

	1	2	3	4	5	6	7	8	9
	Class	Type or model	Length	Width	Height	Square feet	Cubic feet	Short tons	Meas tons
			(Dimensions—in.)						
2		Motorcycle, solo, chain-driver	88	37	59	23	111	0.3	1.9
3		Automobile, sedan, light, 5-passenger.	197	74	66	101	557	1.7	14.0
4		Automobile, sedan, medium, 5-passenger.	207	76	63	109	575	1.8	14.4
5	¼-ton	Frontline amb, 4 x 4, M170	155	61	57	136	647	1.5	6.6
6	2½-ton	Truck, crane, 6 x 6	303	96	99	200	1,655	9.9	41.7
7	2½-ton	Truck, shop van, 6 x 6	263	99	130	180	1,938	7.5	49.0
8	2½-ton	Truck, medical van, 6 x 6	150	96	129	100	1,074	7.5	27.0

g. Trailers (less those peculiar to other technical services).

	1	2	3	4	5	6	7	8	9
	Class	Type or model	Length	Width	Height	Square feet	Cubic feet	Short tons	Meas tons
			(Dimensions—in.)						
2	¼-ton	Cargo, 2-wheel, M100	109	56	42	42	148	0.3	3.7
3	¾-ton	Cargo, 2-wheel, M101	147	74	83	75	521	.7	13.2
4	1½-ton	Cargo, 2-wheel, M105A2	166	83	97	97	785	1.2	19.3
5	1½-ton	Water, tank, 2-wheel, 400 gal, M107A1.	166	93	78	107	697	1.2	17.5
6	2-ton	Ammunition, M10	140	86	58	84	405	1.0	10.1
7		Director, M22 (AA)	189	96	100	126	1,050	4.5	26.1
8		Generator, 4-wheel, M7, M18	189	96	44	126	462	2.1	11.5

h. Semitrailers (less those peculiar to other technical services.)

	1	2	3	4	5	6	7	8	9
1	Class	Type or model	Length	Width	Height	Square feet	Cubic feet	Short tons	Meas tons
			(Dimensions—in.)						
2	6-ton -----	Cargo, 2-wheel -----	274	93	96	177	1,415	3.6	35.6
3	6-ton -----	Van type, 2-wheel -----	276	96	134	184	2,580	3.7	51.5
4	12-ton -----	Cargo, 4-wheel -----	344	97	109	232	2,102	6.9	52.9
5	-----	Gasoline, tank, 4-wheel, 5,000-gallon.	353	97	109	238	2,160	7.4	54.2
6	-----	Semitrailer, low bed, wrecker, 4-wheel, M270.	591	97	121	398	4,011	8.75	100.28
7	-----	Semitrailer, 4-wheel -----	600	97	93	405	3,116	6.5	-----
8	25-ton -----	Semitrailer, towed, 4-wheel -----	403¼	115⅙	63⅝	322	1,711	6.5	-----
9	20-ton -----	Semitrailer, S&P, 4-wheel, 34-ft -----	413⅛	96⅙	122⅜	276	2,790	6.3	-----
10	20-ton -----	Semitrailer, van, 4-wheel, 34-ft -----	413	96⅙	137½	275	3,125	6.3	-----

i. Towed Weapons.

	1	2	3	4	5	6	7	8	9
1	Class	Type or model	Length	Width	Height	Square feet	Cubic feet	Short tons	Meas tons
			(Dimensions—in.)						
2	Antiaircraft MG	Multiple mount, tlr, M55 (cal .50)	112	68	60	53	265	1.8	-----
3	Antiaircraft gun	40-mm, M1 (carrier M2A1, AA)	226	72	80	113	754	2.9	18.8
4	-----	75-mm, T83E7 (mount T69)	305	102	85	216	1,534	9.6	38.3
5	-----	90-mm, AA, M2 (mount M2, AA)	355	103	121	254	2,561	16.1	64.0
6	-----	120-mm, AA, M1A3 (mount M1A1, AA)	369	124	124	308	3,281	30.7	81.6
7	FA howitzer	105-mm, M2A1 (carriage M2A2)	236	82	66	135	742	2.5	18.5
8	-----	155-mm, M1 (carriage M1A2)	288	96	81	191	1,291	6.0	32.4
9	-----	8-in, M2 (carriage M1) ¹	480	99	103	330	2,839	15.8	70.8
10	FA gun	155-mm, M2 (carriage M1) ¹	412	99	109	283	2,567	15.3	63.7
11	-----	280-mm, T131 (carriage T72)(with gun-lifting trucks, M249 and M250).	1,010	124	146	871	10,590	76.0	264.5
12	Launcher	Rocket, multiple, 4.5-inch, M21	179	80	58	99	481	-----	-----
13	AD GM NIKE-AJAX.	Launcher-loader, GM/NIKE I	243	57	38	96.2	304	2.0	7.6

¹ With limber.

5.9. Items of Quartermaster Equipment^{1 2}

1	1	2	3	4	5	6	7	8	9
	Class	Type or model	Length	Width	Height	Square feet	Cubic feet	Short tons	Meas tons
			(Dimensions—in.)						
2	Trailers -----	Bath unit, field, mobile -----	151	72	68	76	428	2.1	10.6
3	Trailers -----	Laundry, mobile, two-trailer type, M1955:	164	84	84	96	670	2.5	16.7
4	-----	Washer trailer -----							
5	-----	Tumbler trailer -----	164	84	90	96	716	2.5	17.9
6	Trailers -----	Bakery unit, mobile, M1945:	197	88	111	121	1,113	5.5	27.8
7	-----	Mixing and make-up machinery trailer.							

¹ Items exceeding 1 short ton, uncrated.

² Weights of vehicles shown in column 8 are weights of vehicles *not* loaded.

	1	2	3	4	5	6	7	8	9
1	Class	Type or model	Length	Width	Height	Square feet	Cubic feet	Short tons	Meas tons
			(Dimensions—in.)						
8		Bakery unit, mobile, M1945—Cont.							
9		Oven trailer	200	88	83	122	847	3.3	21.1
10		Generator set, gasoline-driven, wheel-mounted, 30 kw.	150	71	96	74	592	2.4	14.8
10	Trailers	Reclamation and maintenance, 2-ton:							
11		Clothing repair trailer	108	67	66	50	276	2.2	6.9
12		Textile repair trailer	108	67	66	50	276	2.2	6.9
13		Shoe repair trailer	108	67	66	50	276	2.4	6.9
14	Semitrailers	7½-ton refrigerator	246	83	129	142	1,525	3.2	38.5
15		Petroleum laboratory, mobile	300	96	118	200	1,968	9.5	49.2

5.10. Items of Signal Equipment

	1	2	3	4	5	6	7	8	9
			Length	Width	Height				
1	Class	Type or model	(Dimensions—in.)			Square feet	Cubic feet	Short tons	Meas tons
2	Facsimile-----	AN/TXC-1 transceiver-----	17 $\frac{5}{8}$	34 $\frac{5}{8}$	10 $\frac{3}{4}$	-----	-----	.0425	.1
		Power unit, PP-86-----	10	12	9	-----	-----	.024	.015
		Converter, CU-2-----	9 $\frac{1}{4}$	12 $\frac{9}{16}$	8 $\frac{3}{8}$	-----	-----	.015	.013
3	Line cons eqp----	Reel unit, RL-26E-----	42	40	30	-----	-----	.218	.74
		Reel unit, RL-31E-----	22 $\frac{1}{2}$	32	32	-----	-----	.039	.33
4	Radio VHF-----	*AN/GRC 3-8-----	25	13	14	-----	-----	.175	.21
		*AN/VRQ 1-3-----	(2VRCs)-----			-----	-----	.11	.42
		*AN/VRC 8-10-----	25	13	14	-----	-----	.058	.21
		*AN/VRC 13-15-----	25	13	14	-----	-----	.076	.21
		*AN/VRC 16-18-----	25	13	14	-----	-----	.064	.21
		*AN/PRC 8-10-----	12	4	20	-----	-----	.0125	.014
5	HF radio-----	AN/GRC-26-----	260	90	115	162	1,560	2.75	39
		*AN/GRC-46 w/tlr-----	198	75	110	103	950	2.2	23.7
6	Radio relay-----	*AN/GRC-10-----	30	13 $\frac{1}{8}$	16	-----	-----	.085	.09
		AN/GRC-39-----	2 (GRC-10's)-----			-----	-----	.17	.18
		AN/GRC-40-----	3 (GRC-10's)-----			-----	-----	.25	.27
		AN/TRC-24-----	18	CRATES-----			-----	.825	-----
		AN/TRC-35-----	24	CRATES-----			-----	1.175	-----
		AN/TRC-36-----	40	CRATES-----			-----	1.6	-----
		AN/TRC-29-----	-----	-----	-----	-----	-----	-----	-----
7	Switching and control equipment.	Cen off tp, man, AN/TTC-7-----	72	26 $\frac{3}{16}$	36 $\frac{1}{2}$	-----	-----	.425/pos	1
		Swbd tp, man, SB-86/P-----	21 $\frac{1}{2}$	23 $\frac{1}{4}$	50	-----	-----	.08/pos	.36
		Cen off tp, man, AN/TTC-5-----	-----	-----	-----	-----	-----	.2/pos	-----
8	Tp transmission equipment.	Term tp, AN/TCC-3-----	18	20 $\frac{5}{8}$	26 $\frac{1}{4}$	-----	-----	.089	.135
		Rptr tp, AN/TCC-5-----	18 $\frac{1}{16}$	20 $\frac{5}{8}$	12 $\frac{13}{16}$	-----	-----	.042	.07
		Term tp, AN/TCC-7-----	18 $\frac{1}{16}$	20 $\frac{5}{8}$	93 $\frac{13}{16}$	-----	-----	.375	.5
		Rptr tp, AN/TCC-8-----	18 $\frac{1}{16}$	20 $\frac{5}{8}$	63 $\frac{3}{8}$	-----	-----	.255	.34
9	Teletype equipment.	AN/FGC-20-21-----	21 $\frac{3}{4}$	21 $\frac{1}{4}$	34 $\frac{3}{4}$	-----	-----	.0425	.26
		AN/FGC-25-26-----	24	40	38	-----	-----	.1	.53
		AN/FGC-38:-----	-----	-----	-----	-----	-----	-----	-----
		Revtr bay-----	33	29	77 $\frac{1}{2}$	-----	-----	.315	1.05
		Xmtr gp-----	27	42 $\frac{1}{2}$	67 $\frac{1}{2}$	-----	-----	.35	1.1
		Monitor-----	27	24	77 $\frac{1}{2}$	-----	-----	.31	.725
		AN/PGC-1 (in case)-----	24 $\frac{3}{8}$	20 $\frac{7}{8}$	16 $\frac{7}{8}$	-----	-----	.0215	.12

See footnotes at end of table.

7	1	2	3	4	5	6	7	8	9
1	Class	Type or model	Length	Width	Height	Square feet	Cubic feet	Short tons	Meas tons
			(Dimensions—in.)						
10	Teletype transmission equipment.	Telegraph term AN/TCC-4 (5 pkg).	18½	20½	76½	-----	-----	.21	.41
		Telegraph term AN/TCC-20.	33¾	18½	20½	-----	-----	.093	.18
11	Wire-----	Cable assembly CX-162/G.	-----	-----	-----	-----	-----	.35/M1	-----
		Cable assembly CX-1065/G.	-----	-----	-----	-----	-----	.195/M1	-----
		Wire WD-1/TT.	-----	-----	-----	-----	-----	.024/M1	-----
12	Trucks-----	Sig Corps repair, M-30, 2½t, 6 x 6.	256	92	118	164	1,610	8	40.2
		Tp cons and maint, V-17/MTQ, 2½t, 6 x 6.	265	88	108	162	1,460	5.5	36.5
		Earth auger, V-18/MTQ, 2½t, 6 x 6.	265	88	108	162	1,460	5.5	36.5
		*12-ch rad rel, AN/MRC-69, 2½t, M-211.	260	90	125	163	1,695	7	42.4
		*12-ch rprr, AN/MRC-54, 2½t, M-211.	260	90	125	163	1,695	7	42.4
		4-ch rad rel, AN/MRC-68, ¾t, M-408, w/trlr.	198	75	110	103	947	4	23.6
13	Trucks-----	Man tp cen off	260	90	125	163	1,695	7	42.4
		*AN/MTC-3, 2½t, M-211.							
		Man tp cen off.	198	75	110	103	947	4	23.6
		*AN/MTC-7, ¾t, M-408.							
		Teletype term gp	260	90	125	163	1,695	7	42.4
		*AN/MSA-12, 2½t, M-211.							
		Teletype cen off	198	75	110	103	947	4	23.6
		*AN/MGC-17, ¾t, M-408.							
		Lab darkroom	260	90	125	163	1,695	8	42.4
		*AN/TFQ-7, 2½t, 6 x 6.							
		Term tg	260	90	125	163	1,695	8	42.4
		*AN/MSC-29, 2½t, 6 x 6.							
14	Trailers-----	Cable hauler, K-37, 2W-----	149	84	69	87	500	1.5	12.5
		Cable splicer, K-38, 2W-----	77	39	42	21	73	.2	1.8
		Pole hauling, V-13/GT, 2W-----	185	88	60	113	565	1.2	14.1
		1-ton, cargo, K-52, 2W-----	145	72	73	73	440	1.5	11.0
		*1½t, SB-611/MRC-----	166	83	97	96	775	1.6	19.3

* Estimated values.

Note. All dimensions are for uncrated items.

5.11. Items of Transportation Equipment^{1 2}

	1	2	3	4	5	6	7	8	9
1	Class	Type or model	Length	Width	Height	Square feet	Cubic feet	Short tons	Meas tons
			(Dimensions—in.)						
2	Airplane ³ -----	L-19, fixed wing, observation-----	300	47	90	100	750	1	⁴ 18
3	-----	L-20, fixed wing, utility-----	363.6	52	124.8	131	1,651	1.6	⁴ 32
4	-----	L-23, fixed wing, command-----	378	195	135.6	513	5,857	2	⁴ 145
5	-----	U-1A, fixed wing, light cargo-----	501.6	140	151.2	489	6,162	-----	⁴ 151
6	Helicopter ³ -----	H-13, rotary wing, reconnaissance-----	382	114	113	303	2,922	1	⁴ 73
7	-----	H-19, rotary wing, utility-----	548	139	110	545	3,590	2.7	⁴ 175

See footnotes at end of table.

	1	2	3	4	5	6	7	8	9
1	Class	Type or model	Length	Width	Height	Square feet	Cubic feet	Short tons	Meas tons
			(Dimensions—in.)						
8	-----	H-21, rotary wing, light cargo-----	631	168	189	761	12,170	3.7	⁴ 290
9	-----	H-23, rotary wing, reconnaissance-----	338	92	128	216	2,300	1	⁴ 51
10	-----	H-34, rotary wing, light cargo-----	530	144	170	480	6,880	3.6	⁴ 188
11	-----	H-37, rotary wing, medium cargo-----	668	328	180	1,520	22,910	9.9	⁴ 577
12	-----	H-40, rotary wing, utility-----		97.2	175.2				
13	Vessel-----	Supply, diesel, steel, 176-ft, design 381. ⁷	2,118	384	-----	5,648	-----	510.8	
14	Barge-----	Deck or liquid cargo, nonpropelled, steel, design 218E, knocked down.	545	216	54	818	3,681	14.5	92
15	-----	Deck cargo, nonpropelled, steel, 81-ft, design 7001, sectionalized, nesting.	972	264	84	1,782	12,474	64.4	311.9
16	-----	Deck cargo, nonpropelled, steel, 120-ft, design 231A. ⁶	1,440	396	126	3,960	41,580	196	1,039.5
17	-----	Liquid cargo, nonpropelled, steel, 235-ft, design 7004. ⁶	2,820	480	⁵ 141	9,400	110,450	392	2,761.3
18	-----	Refrigerated cargo, nonpropelled, steel, 14,200 cu ft, 120-ft, design 7010. ⁶	1,440	396	⁵ 120	3,960	39,600	257.6	990
19	-----	Liquid cargo, self-propelled, diesel, steel, 182-ft, design 294A ⁷	2,190	360	204	5,475	93,075	533	2,326.9
20	-----	Inland waterways, self-propelled, diesel, steel, 55-ft, design 3011.	674	180	91	843	5,691	47.1	142.1
21	-----	Deck cargo, nonpropelled, steel, 570 tons, 110-ft, design 7005 ⁶	1,320	384	-----	3,520	-----	134.4	
22	-----	Deck or liquid cargo, nonpropelled, 578 tons, or 4,160 bbl, 120-ft, design 231B, knocked down. ⁶	1,440	396	-----	3,960	-----	196	
23	-----	Pier, nonpropelled, steel, 150-ft, design 380, knocked down.	1,800	600	-----	2,250	-----	278.9	
24	-----	Repair shop, floating, marine equipment, nonpropelled, steel, 510-ft, design 7011 ⁶ .	2,525	480	-----	8,424	-----	1,300	
25	Boat-----	Utility, diesel, plastic, 26-ft, design 6009.	318	97	⁵ 69	214	1,231	3.4	30.8
26	-----	Picket, diesel, steel, 46-ft, design 4003.	556	147	156	568	7,384	11	184.6
27	-----	Picket, diesel, wood, 36-ft, design 243B.	438	127	112	386	3,602	6.8	90.1
28	-----	Picket, diesel, wood, 63-ft, design 4002.	779	191	192	1,032	16,512	34.7	412.8
29	-----	Passenger and cargo, diesel, steel, 65-ft, design 2001.	786	212	252	1,158	24,318	74	608
30	-----	Aircraft rescue, gasoline, wood, 85-ft, design 379.	1,020	243	134	1,722	18,942	35.3	473.6
31	Crane-----	Barge, diesel-electric, revolving, steel, 89 long tons, design 264B ⁵	1,680	840	-----	9,800	-----	15,688	
32	-----	Barge, diesel-electric, revolving, steel, 60 long tons, design 413D. ⁶	1,704	696	-----	8,236	-----	1,120	
33	Landing craft--	Mechanized, diesel, steel, Mark VI, Navy design LCM (6).	672	168	160	784	10,192	31.4	254.8
34	-----	Mechanized, diesel, steel, Mark VIII, Navy design LCM (8).	884	252	164	1,550	21,090	67.2	527.3
35	-----	Utility, diesel, steel, Navy design LCU 1466 class, sectionalized.	1,380	408	261	3,910	85,043	201.6	2,126.1

See footnotes at end of table.

	1	2	3	4	5	6	7	8	9
1	Class	Type or model	Length	Width	Height	Square feet	Cubic feet	Short tons	Meas tons
			(Dimensions—in.)						
36		Vehicle, personnel, diesel, wood, 36-ft, Navy design LCVP.	432	125	130	382	4,126	9	103.2
37	Propelling unit	Marine, outboard, diesel, 165 HP, design 9002.	307	60	77	127	828	7.5	20.7
38	Tug	Harbor, diesel, 200 hp, steel, 45-ft, design 320.	543	150	180	565	8,475	28.2	211.9
39		Harbor, diesel, 600 hp, 65-ft, design 3004.	840	234	273	1,365	30,054	112	751.4
40		Harbor, diesel, 1,200 hp, 100-ft, design 30067.	1,284	318		2,840		320.5	
41		Oceangoing, diesel-electric, 1,530 hp, steel, 143-ft, design 377A ⁷	1,721	396		4,736		623	
42	BARC	Carrier, cargo, amphibious, design BARC.	751	319	249	1,658	34,404	97.5	860.1
43	Ponton	Sectional, curved end, steel, 7 ft x 7 ft x 5 ft ½ in., Mark T-7A, w/connectors.	84	84	61	49	245	1.4	6.12
44		Sectional, end ramp, steel, 5 ft ½ in. x 7 ft x 3 ft 6 in., Mark T-11, w/connectors.	61	84	42	35	123	0.9	3.1
45		Sectional, intermediate ramp, steel, 5 ft ½ in. x 7 ft x 4 ft 11⅜ in., Mark T-8, w/connectors.	61	84	60	35	175	1.1	4.4
46		Sectional, rectangular, steel, 7 ft x 5 ft ½ in. x 5 ft ½ in., Mark T-6B, w/connectors.	84	61	61	35	175	1	4.4
47	Locomotive, steam	60-ton, 2-8-2 road	428½	102⅜	136	304	3,465	52	89.3
	(36-39⅜-42-in.).	Tender	285	102⅜	136	202	2,285	20.8	57.5
48	Locomotive, steam	82-ton, 2-8-0 road	393½	116	163	321	4,330	74	107
	(56½-60-63-66-in.).	Tender	286	116	163	234	3,158	23.2	77.8
49	Locomotive, diesel, electric	48-ton, 0-4-4-0 road switcher	420	102	136	298	3,380	58	84.3
	(36-39⅜-42-in.).								
50	Locomotive, diesel, electric	60-ton, 0-4-4-0 road switcher	420	102	136	298	3,380	58	84.3
	(56½-60-63-66-in.).								
51	Locomotive, diesel, electric	80-ton, 0-6-6-0 road switcher	504	108	131	378	4,130	72	103.2
	(36-39⅜-42-in.).								
52	Locomotive, diesel, electric	120-ton, 0-6-6-0 road switcher	642	116	163	518	3,380	116.2	175.6
	(56½-60-63-66-in.).								
53	Railway cars	Box, 30-ton	458¼	95⅜	128¾	302	3,230	13.6	450.6
	(36-39⅜-42-in.).								
54		Gondola, low side, 30-ton	458¼	95⅜	62	302	1,560	12.1	424.0
55		Gondola, high side, 30-ton	458¼	95⅜	92	302	2,315	13.3	427.5
56		Flat, 30-ton	458¼	95⅜	44	302	1,110	11	420.6

See footnotes at end of table.

	1	2	3	4	5	6	7	8	9
	Class	Type or model	Length	Width	Height	Square feet	Cubic feet	Short tons	Meas tons
			(Dimensions—in.)						
57		Tank, 6,000-gal.....	419 $\frac{3}{4}$	95 $\frac{3}{8}$	145	278	3,350	17.5	84.0
58		Ambulance, ward.....	734 $\frac{1}{4}$	100	133 $\frac{3}{16}$	509	5,650	46	140.4
59		Ambulance, kitchen-diner-storage..	734 $\frac{1}{4}$	100	133 $\frac{3}{16}$	509	5,650	45.5	140.4
60		Ambulance, personnel.....	734 $\frac{1}{4}$	100	133 $\frac{3}{16}$	509	5,650	45	140.4
61	Railway cars (56 $\frac{1}{2}$ -60-63- 66-in.).	Box, 40-ton.....	530 $\frac{3}{4}$	114	139 $\frac{7}{16}$	420	4,885	18	4 59.0
62		Gondola, low side, 40-ton.....	530 $\frac{3}{4}$	114	74 $\frac{1}{16}$	420	2,582	15.2	4 28.0
63		Gondola, high side, 40-ton.....	530 $\frac{3}{4}$	114	104 $\frac{1}{16}$	420	3,640	17.7	4 32.1
64		Flat, 40-ton.....	530 $\frac{3}{4}$	114	56 $\frac{1}{16}$	420	1,631	14.4	4 24.0
65		Flat, depressed center, 70-ton ⁸	492	116	40	396	1,334	38	4 33.1
66		Flat, 80-ton.....	603 $\frac{1}{2}$	116	52 $\frac{1}{8}$	486	2,104	35.5	4 27.6
67		Tank, 10,000-gal.....	505 $\frac{1}{2}$	114	157 $\frac{13}{16}$	399	5,240	20	140.5
68		Refrigerator, 40-ton.....	530 $\frac{3}{4}$	114	139 $\frac{7}{16}$	420	4,885	19	4 59.0
69		Ambulance, ward.....	794	114	157	628	8,220	55.2	179.3
70		Ambulance, kitchen-diner-storage..	794	114	157	628	8,220	54.7	179.3
71		Ambulance, personnel.....	794	114	157	628	8,220	54.2	179.3
72	Cargo transporter.	Box, metal, shipping, steel, capacity 295 cu ft, max load 9,000 lb.	102	75	82 $\frac{1}{2}$	53	366	.75	9.1

¹ Items exceeding 1 short ton, uncrated.

² Weights of vehicles shown in column 8 are weights of vehicles not loaded.

³ Slight variation in specifications on different models; e.g., L-20A, L-20B, etc.

⁴ Knocked down.

⁵ Indicated height does not include equipment above deck.

⁶ May be towed to destination.

⁷ Self-deliverable.

⁸ Car is not designed to operate on 63-inch gage.

5.12. Items of Construction and Fortification Materials¹

a. Engineer.

	1	2	3
	Type or model	Short ton	Meas tons
2	Asphalt/mile (22-ft wide, 3-in. thick).....	80.7	70.0
3	Cement.....	1.0	.53
4	Explosive (60% dynamite).....	1.0	1.0
5	Track, 85 lb/yard, rail/mile of track.....	149.6	45.3
6	Track, rail turnout, complete, 85 lb/yard, each.....	9.0	6.3
7	Sandbags, per 100,000.....	16.5	100.0
8	Loose, pit run gravel.....	1.4	1.0
9	Crushed rock, loose.....	1.34	1.0
10	Pipe, 4-in., with fittings (1 mi).....	24.2	-----
11	Pipe, 6-in., lt, with fittings and pump (1 mi).....	33.0	-----
12	Pipe, 6-in., hv, with fittings and pump (1 mi).....	49.5	-----
13	Tank, 10,000-barrel, steel.....	46.0	-----

b. Signal.

1	1	2	3
	Type or model	Short ton	Meas tons
14	Wire, WD-1()/TT, on spool, DR-8-().....1,320 ft, 13 lb		
15	Wire, WD-1()/TT, on wire reel, RL-159()/U.....5,280 ft, 66 lb		
16	Wire, WD-1()/TT, on reel, DR-5.....2½ mi, 145 lb		
17	Wire, WD-1()/TT, on wire dispenser, MX-306()/G (wire, WD-1)/(TT alone weighs 46 lb per mile).....2,640 ft, 26 lb		
18	100-mi requirements (spiral four cable) without poles.....	26.5	39.0
19	Same with poles.....	187.5	282.0
20	300 miles, open wire, crossarms, hardware, etc., without poles.....	527.0	502.0
21	Same with poles.....	3,067.0	3,842.0
22	100-mi tactical radio (radio relay with carrier eqp).....	42.0	104.0

¹ Items exceeding 1 short ton, uncrated.

Section IV. CLASS III SUPPLY

5.13. Liquid Fuel and Lubricant Data

a. Vehicles.

1	2	3 ¹	4 ¹	5	6
Vehicle	Vehicle fuel tank capacity (gal)	Fuel per 100 miles (gal)	Oil per 100 miles (gal)	Gear lubricant per 100 miles (lb)	Miscellaneous greases per 100 miles (lb)
2 Automobile, sedan, light.....	16	5.8	.2	.1	.1
3 Automobile, sedan, medium.....	17	6	.2	.1	.1
4 Automobile, sedan, heavy.....	20	7	.2	.1	.1
5 Carrier, cargo, M29.....	35	20	1.5	.8	.5
6 Carrier, cargo, amphibian, M29C ²	35	23	1.5	1.0	.5
7 Carrier, cargo, amphibian, M76 (T46E1).....	60	30	2.2	.8	1.5
8 Carrier, lt wpr, inf, ½-ton, 4 x 4, M274.....	8	(*)			
9 Carrier, personnel, FT, armored, M59.....	130	100	2.0		2.0
10 Carrier, personnel, FT, armored, M75.....	150	130	3.2		2.5
11 Compressor, air, trk-mtd.....	40	13.3	.3	.5	.3
12 Crane, truck-mounted, ¾-yd capacity.....	50	40	.4	.8	.4
13 Grader, road, mtz, diesel.....	27	72	.8	12.5	2.0
14 Gun, SP, HT, M16, M16A1, M16A2.....	60	34	1.8	1.0	2.4
15 Gun, twin 40-mm, SP, M42 (T141).....	140	140	4.0	1.5	2.0
16 Gun, twin 40-mm, SP, M42A1.....	140	117	4.0	1.5	2.0
17 Gun, 90-mm, SP, full-tracked, M56.....					
18 Gun, 155-mm, SP, (T97), M53.....	350	234	4.0	1.7	2.8
19 Howitzer, SP, FT, 105-mm, M37.....	110	110	2.7	1.5	2.5
20 Howitzer, 105-mm, SP, (T98E1), M52.....	174	200	4.1	1.5	2.5
21 Howitzer, 105-mm, SP, M52A1.....	176	166	4.1	1.5	2.5
22 Howitzer, SP, FT, 155-mm, M41.....	110	111	4.0	1.5	2.4
23 Howitzer, SP, FT, 8-in., M43.....	195	195	5.0	1.5	3.0
24 Howitzer, 155-mm, SP, M44 (T99E1).....	150	200	3.9	1.5	2.5
25 Howitzer, 155-mm, SP, M44A1.....	150	166	3.9	1.5	2.5
26 Howitzer, 8-inch, SP, (T108), M55.....	350	234	4.0	1.7	2.8
27 Landing vehicle, tracked, MK4 ³	140	L71 W140	3.6	1.5	3.0
28 Landing vehicle, wheeled, 2½-ton, 6 x 6.....	40	16.7	.6	.9	.3
29 Mortar, SP, HT, 81-mm, M21.....	60	34	1.4	.5	1.0
30 Mortar, SP, FT, 4.2-inch, M84.....	130	130	2.0		2.0

See footnotes at end of table.

	1	2	3 ¹	4 ¹	5	6
	Vehicle	Vehicle fuel tank capacity (gal)	Fuel per 100 miles (gal)	Oil per 100 miles (gal)	Gear lubricant per 100 miles (lb)	Miscellaneous greases per 100 miles (lb)
31	Motorecycle, solo	3.5	2.4	.2	.1	.1
32	Motorscooter	2	2	.2	.1	.1
33	Shop equipment, mtz, GP	45	20	.4	.8	.4
34	Tank, combat, FT, 76-mm gun, M41, M41E, M41A1	140	140	3.7	1.5	2.5
35	Tank, combat, FT, 76-mm gun, M41A2, M41A3	140	83.3	3.7	1.5	1.5
36	Tank, combat, FT, medium, 90-mm gun, M47	232	290	5.6	1.5	2.5
37	Tank, combat, FT, medium, 90-mm gun, M48, M48A1	215	295	5.1	2.0	1.0
38	Tank, combat, FT, medium, 90-mm gun, M48A2	330	246	5.1	2.0	1.0
39	Tank, combat, FT, heavy, 120-mm gun, M103	280	350	5.2	1.5	2.5
40	Tank, flamethrower, (T67), M67	215	295	5.1	2.0	1.0
41	Tank recovery vehicle, heavy, M51	385	296	4.1	2.0	2.5
42	Tractor, FT, high-speed, M8A1	225	125	3.8	1.5	3.0
43	Tractor, FT, high-speed, M8A2	225	104	3.8	1.5	3.0
44	Tractor, high-speed, 13-ton, M5	80	53	2.0	1.5	2.0
45	Tractor, high-speed, 18-ton, M4	125	125	2.1	1.5	2.0
46	Tractor, high-speed, 38-ton, M6	300	330	2.8	1.5	2.0
47	Truck, cargo, $\frac{3}{4}$ -ton, 4 x 4	24	12	.2	.3	.3
48	Truck, cargo, $2\frac{1}{2}$ -ton, 6 x 6, M34	50	20	.4	.8	.4
49	Truck, cargo, $2\frac{1}{2}$ -ton, 6 x 6, M35	50	20	.4	.8	.4
50	Truck, cargo, $2\frac{1}{2}$ -ton, 6 x 6, M135	56	22.2			
51	Truck, cargo, $2\frac{1}{2}$ -ton, 6 x 6, M211	56	17.2			
52	Truck, utility, $\frac{1}{4}$ -ton, 4 x 4	17	7.1	.2	.2	.2
53	Truck, gun, lifting, heavy, 4 x 4, front, M249	140	100			
54	Truck, gun, lifting, heavy, 4 x 4, rear, M250	140	100			
55	Truck, 5-ton, 6 x 6, M41	78	32.3	.6	.9	.8
56	Truck, 5-ton, 6 x 6, M54	78	32.3	.8	.4	.5
57	Truck, 10-ton, 6 x 6, M125	150	50	.8	.8	1.0
58	Truck, medium wrecker, 5-ton, 6 x 6, M62	78	37	.8	.4	.5
59	Truck, tractor, $2\frac{1}{2}$ -ton, 6 x 6, M275	50	18	.4	.8	.4
60	Truck, tractor, $2\frac{1}{2}$ -ton, 6 x 6, M221	56	22.2	.4	.8	.4
61	Truck, tractor, 10-ton, 6 x 6, M123	150	**50	.8	.8	1.0
62	Truck, tractor-wrecker, 5-ton, 6 x 6, M246	50	18	.4	.8	.4
63	Truck, wrecker, crane	100	66.7	.7	.7	.5
64	Truck-tractor, 4-5 ton (7-ton semitrailer)	60	22	.6	1.2	.8
65	Truck-tractor, 5-ton, 6 x 6, M52	110	34	.6	.9	.8
66	Truck-tractor, 12-ton, 6 x 6, M26A1 (tk transporter)	120	100	1.5	.9	1.1

¹ For arctic winter operations, increase amounts by 25 percent.

² In water, the weasel, M29C, uses $2\frac{1}{2}$ gallons of fuel per hour.

³ In water, use 0.6 miles per gallon.

* 5 hours' continuous operation at walking speed, cross country, is only MCV requirement.

** Unless used with M15A1, modified semitrailer for transporting M48 tank.

b. Army Aircraft.^{1 2}

	1	2	3
	Type	Type of fuel (See TB AVN 2 for alternate fuel)	Estimated average rate of consumption in gallons per hour
2	L-19E Fixed wing, observation.....	Grade 80 MIL-F-5572	8.5
3	L-20B Fixed wing, utility.....	Grade 91/96 MIL-F-5572	23
4	L-23D Fixed wing, command.....	Grade 100/130 MIL-F-5572	26
5	U-1A Fixed wing, light cargo.....	Grade 91/96 MIL-F-5572	32
6	H-13G Helicopter, reconnaissance.....	Grade 91/96 MIL-F-5572	15
7	H-19D Helicopter, utility.....	Grade 91/96 MIL-F-5572	57
8	H-21C Helicopter, cargo, light.....	Grade 100/130 MIL-F-5572	103
9	H-23C Helicopter, reconnaissance.....	Grade 91/96 MIL-F-5572	12
10	H-34A Helicopter, cargo, light.....	Grade 100/130 MIL-F-5572	110
11	H-37A Helicopter, cargo, medium.....	Grade 115/145 MIL-F-5572	206
12	H-40 Helicopter, utility.....	Grade 91/96 MIL-F-5572	45

¹ Slight variation in specifications on different models; e.g., L-20A, L20B, etc.

² Add 5 percent to provide for warmup, climb, and other contingencies.

c. Locomotives.

(1) Fuel oil (oil-burning steam locomotives).

	1	2	3	4
	Type of locomotive	Type of operation	Estimated average rate of fuel oil consumption	
			Pounds/train mile	Pounds/hour
2	2-8-0 standard gage.....	Road..	55	450
3	2-8-2 narrow gage.....	Road..	60	500

(2) Diesel oil (diesel-electric locomotives).

	1	2	3	4
	Type of locomotive	Type of operation	Estimated average rate of diesel oil consumption	
			Gallons/train mile	Gallons/hour
2	Standard gauge:			
	0-6-6-0, DE, 120-T..	Roadswitcher..	2.5	11.5
	0-4-4-0, DE, 60-T..	Roadswitcher..	.9	8.0
3	Narrow gauge:			
	0-6-6-0, DE, 80-T..	Roadswitcher..	1.5	10.0
	0-4-4-0, DE, 48-T..	Roadswitcher..	.9	8.0

In estimating fuel requirements, it is recommended that 5 percent be added to computed rate of consumption to allow for contingencies.

- (3) **Lubricants.** Estimated lubricating oil and grease requirements for motive power and rolling stock: 1,000 pounds per month for each train per day (moving in either direction) over each division.

d. Marine.

	1	1	3
1	Type	Type of fuel	Estimated average rate of consumption in gallons per hour
2	Tug, harbor, diesel, 200-hp, steel, 45-ft, design 320.....	Diesel	12
3	Tug, harbor, diesel, 600-hp, steel, 65-ft, design 3004.....	Diesel	41
4	Tug, harbor, diesel, 1,200-hp, steel, 100-ft, design 3006.....	Diesel	83
5	Tug, oceangoing, diesel-electric, 1,530-hp, steel, 143-ft, design 377A.....	Deisel	130
6	Barge, liquid cargo, self-propelled, diesel, steel, 6,500-bbl, 182-ft, design 294A.....	Diesel	43
7	Barge, inland waterways, self-propelled, diesel, steel, 55-ft, design 3011.....	Diesel	22
8	Boat, passenger and cargo, diesel, steel, 65-ft 6-in., design 2001.....	Diesel	19
9	Boat, utility, diesel, plastic, 26-ft 6-in., design 6009.....	Diesel	4
10	Boat, aircraft rescue, gasoline, wood, 85-ft, design 379.....	Gasoline	152.6 (main) 13.6 (auxiliary)
11	Vessel, supply, diesel, steel, 176-ft, design 381.....	Diesel	69
12	Boat, picket, diesel, wood, 36-ft 6-in., design 243B.....	Diesel	10
13	Boat, picket, diesel, wood, 63-ft, design 4002.....	Diesel	25
14	Boat, picket, diesel, steel, 46-ft 4½-in., design 4003.....	Diesel	18
15	Propelling unit, outboard, diesel, 165-hp, design 9002.....	Diesel	11
16	Landing craft, mechanized, diesel, steel, Mark VI, Navy design LCM(6).....	Diesel	28
17	Landing craft, utility, diesel, steel, 115-ft, Navy design LCU 1466 class, sectionalized.....	Diesel	34
18	Landing craft, mechanized, diesel, steel, 70-ft, Mark VIII, Navy LCM(8).....	Diesel	38
19	Landing craft, vehicle-personnel, diesel, wood, 36-ft, Navy design LCVP.....	Diesel	14
20	Truck, amphibious, 2½-ton, 6 x 6, DUKW.....	Gasoline	8
21	Carrier, cargo, amphibious, design BARC.....	Diesel	40
22	Crane, barge, diesel-electric, revolving, steel, 60-lton, design 413D.....	Diesel	16
23	Crane, barge, diesel-electric, revolving, steel, 89-lton, design 264B.....	Diesel	25

e. Signal Power Units.

	1	2	3	4
1	Type	Type fuel	Tank capacity (gallons)	Estimated average rate (consumption in gallons per hour) at rated load
2	PE-75	Gasoline.....	1¼	.65
3	PE-95	Gasoline.....	10½	1.8
4	PE-195	Gasoline.....	10	1.1
5	PE-197	Gasoline.....	5	1.2
6	PE-198	Diesel.....	3	3
7	PE-214	Oil and gas	1	.15

5.14. Bulk Petroleum Distribution

	1	2
1	Type carrier	Amount carried
2	Ships (supertanker)	11 to 36.5 million gallons
3	Ships (large tanker)	2.5 to 11 million gallons ¹
4	Ships (small tanker)	600,000 to 2 million gallons ²
5	Barges:	
	Deck or liquid cargo, nonpropelled, steel	9,000 to 175,000 gallons ³
	Liquid cargo, self-propelled, diesel, steel	273,000 gallons ⁴
	Liquid cargo, nonpropelled, steel	546,000 gallons ⁵
6	Railroad tank cars, petroleum:	8,000; 10,000; 12,000 gallons
	36", 39 $\frac{3}{8}$ ", 42" gage, foreign service	6,000 gallons
	56 $\frac{1}{2}$ " gage, domestic service, riveted or welded	10,000 gallons
	56 $\frac{1}{2}$ ", 60", 63", 66" gage, foreign service	10,000 gallons
7	Truck-tractor and trailer, F-2	2,000 gallons
8	Truck-tractor and trailer, F-1	4,000 gallons
9	Truck-tractor and 2 trailers, F-2A	4,000 gallons
10	Truck-tractor, M52, and semitrailer, M131	5,000 gallons
11	Truck-tractor and 2 trailers	8,000 gallons
12	Tank-truck, L-2, oil service	660 gallons
13	Tank-truck, F-3, fuel or oil	750 gallons
14	Tank-trucks, M49 and M217	1,200 gallons
15	Trailer, fuel servicing	600 gallons
16	Pipelines:	
	4-in. ⁶	298,000 gallons per day ⁷ (910 short tons)
	6-in.	660,000 gallons per day ⁷ (2,000 short tons)
	8-in.	1,140,000 gallons per day ⁷ (3,480 short tons)
	12-in.	6,000,000 gallons per day ⁷ (18,300 short tons)
17	Storage tanks:	
	Liquid storage, metal, for POL, horizontal, w/skids	600 gallons
	Collapsible, fabric, portable	900; 3,000; 10,000 gallons
	Bolted steel	4,200; 10,500; 21,000; 42,000; 126,000; 420,000 gallons.

¹The ship tanker most commonly used is the T2-SE-A1, a 5,922,000-gallon tanker. It is 524 feet long and draws 31 feet. It has three 8-inch flanged discharge outlets and 4 discharge pumps rated 1,000 gpm at 100 psi.

²Draft loaded, 12 to 20 feet.

³Rectangular hulls.

⁴Molded hulls.

⁵6 X 18 ponton barge, carrying three 42,000-gallon tanks loaded to two-thirds capacity.

⁶Nominal size.

⁷Based on 20-hour working day and pumping a product having a specific gravity of 0.725.

5.15. Weights, Volumes, and Conversion Factors for Petroleum Products

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Product	Packaging	Wt (lb)	Cubic ft		Conversion factors		Gal per short ton	Gal per long ton	Gal ¹ per measure- ment ton	Bbl ¹ per long ton	Pack- ages per short ton	Pack- ages per long ton	Packages per measure- ment ton	Capacity of vehicles for carrying filled containers ²	
				Actual	Plan- ning factor	Gal to lb	Lb to gal								1½-ton trailer	2½-ton truck
2	Aviation gasoline.	Bulk				5.90	.169	339.0	379.7		9.04					
		55-gal drums ³	373	9.03	11	6.91	.145	289.4	324.2	187.8		5.36	6.00	3.48	8	14
		55-gal drums ⁴	389	8.8	11	7.20	.139	277.8	311.1	192.8		5.14	5.76	3.57	8	13
		55-gal drums ⁵	364	9.2	11	6.90	.145	289.9	324.6	181.2		5.49	6.15	3.42	9	14
		5-gal drums ⁶	40.5	0.81	1	8.0	.125	250.0	280.0	200.0		49.4	55.3	40.0	74	124
3	Motor gas- oline.	Bulk				6.11	.164	327.3	366.6		8.73					
		55-gal drums ³	384	9.03	11	7.11	.141	281.2	315.1	187.8		5.21	5.83	3.48	8	13
		55-gal drums ⁴	400	8.8	11	7.41	.135	269.9	302.3	192.8		5.00	5.60	3.57	8	13
		55-gal drums ⁵	376	9.2	11	7.09	.141	282.1	315.9	181.2		5.32	5.96	3.42	8	14
		5-gal drums ⁶	41.6	0.81	1	8.32	.120	240.4	269.2	200.0		48.1	53.8	40.0	73	121
4	Kerosene	Bulk				6.80	.147	294.1	329.4		7.84					
		55-gal drums ³	421	9.03	11	7.80	.128	256.4	287.1	187.8		4.75	5.32	3.48	8	12
		55-gal drums ⁴	437	8.8	11	8.09	.124	247.2	276.9	192.8		4.58	5.13	3.57	7	12
		55-gal drums ⁵	351	9.2	11	6.62	.151	302.1	338.3	181.2		5.70	6.38	3.42	9	15
		5-gal drums ⁶	45	0.81	1	9.0	.111	222.2	248.9	200.0		44.4	49.8	40.0	67	112
5	Diesel fuel	Bulk				6.99	.143	286.1	320.5		7.63					
		55-gal drums ³	432	9.03	11	8.00	.125	250.0	280.0	187.8		4.63	5.19	3.48	7	12
		55-gal drums ⁴	448	8.8	11	8.30	.120	241.0	269.9	192.7		4.46	5.00	3.57	7	12
		55-gal drums ⁵	430	9.2	11	8.11	.123	246.6	276.2	181.2		4.65	5.21	3.42	7	12
		5-gal drums ⁶	46	0.81	1	9.20	.109	317.4	243.5	200.0		43.5	48.7	40.0	66	109
6	Lubricating oils.	Bulk				7.60	.132	263.2	294.7		7.02					
		55-gal drums ³	472	9.03	11	8.58	.117	233.1	261.0	191.3		4.24	4.75	3.48	7	11
		55-gal drums ⁴	488	8.8	11	8.87	.113	225.5	252.5	196.4		4.10	4.59	3.57	7	11
		55-gal drums ⁵	462	9.2	11	8.56	.117	233.6	261.7	184.6		4.33	4.85	3.42	7	11
		5-gal drums ⁶	49	0.81	1	9.8	.102	204.1	228.6	181.2		40.8	45.7	40.0	62	103
		1-qt cans (12/case)	35	.88	1							58.0	64.9	40	86	143
		1-qt cans (24/case)	60	1.6	2							33.4	37.3	20	50	84
		5-qt cans (6/case)	77	1.9	2						26.0	29.1	20	39	65	
7	Greases	25-lb pails	29	.95	1							69.0	77.2	40.0	104	173
		5-lb cans (6/case)	44	1.1	2							45.4	50.9	20.0	69	114

¹For ocean shipping, storage, and pipeline computations, bulk petroleum products usually are measured in barrels of 42 gallons each, or in long tons.

²Based upon authorized loads in short tons. When overloads are authorized, these quantities may be increased to the cubic capacity of the vehicle or to 100 percent overweight, whichever limit is reached first.

³18-gage standard—weighs 54 lb empty—filled to 54 gallons with light products, 55 gallons with heavy products. Federal Specification PPP-D-729, Amendment 1.

⁴16-gage standard—weighs 70 lb empty—filled to 54 gallons with light products, 55 gallons with heavy products. Federal Specification PPP-D-729, Amendment 1.

⁵18-gage limited standard—weighs 52 lb empty—filled to 53 gallons with light products, 54 gallons with heavy products. Federal Specification PPP-D-729.

⁶For planning purposes, weight of gasoline may be taken as 42 pounds and weight of lubricating oil for engines as 50 lb per 5-gallon drum, including weight of drum. Drums, 5-gallon, weigh approximately 11 lb empty.

5.16. Estimating Class III Requirements

a. *Estimating Solid Fuel Requirements.* The factors given below are based on the use of coal only, assuming use of no petroleum products or gas. When firewood or peat is substituted, 2 pounds of such fuel is required in lieu of 1 pound of coal. Factors are applicable to temperate climate.

(1) Utilities.

Space, water heating and cooking, per man per day.	4 lb
Cooking only, per man per day	1.5 lb
Hospital use, per bed per day:	
Winter	12 lb
Summer	5 lb
Railroad engine, per mile of travel on flat to hilly terrain.	100 lb
Coffee roaster, per day per unit	400 lb
Laundry, fixed, per day per unit	32 short tons

(2) Steam locomotives (coal-burning).

	1	2	3	4
1	Type of locomotive	Type of operation	Estimated average rate of coal consumption	
			Pounds/train mile	Pounds/hour
2	2-8-0 standard gage	Road	90	700
3	2-6-2 narrow gage	Road	100	750

(a) In estimating coal requirements, it is recommended that 10 percent be added to computed rate of consumption to allow for contingencies.

(b) For general planning purposes, assume operation of switch engines for 20 hours a day; allow 4 hours a day for maintenance.

b. *Estimating Gasoline Requirements.* The major factors controlling gasoline requirements in military operations are—

(1) *Displacement.* By measuring the distance that the center of mass is moved, the average mileage moved by each vehicle is determined. Administrative or march movements are computed on the basis of using available road nets. Movements under battle conditions are computed on the basis of selected elements of the organization proceeding cross country. Experience tables provide consumption data on a mileage basis for moving an organiza-

tion. For planning purposes, it is assumed that cross-country battle consumption is at a rate of 2.5 times that given for road movements in the gasoline and oil supply data tables (pars. 5.17-5.23).

(2) *Supply.* During a displacement, certain vehicles of an organization must make round trip supply hauls. Since these hauls generally are made to supply points located at varying distances from the organization, an average round trip supply distance must be determined. Experience indicates that daily requirements for supply hauls are approximately equal to 10 percent of the total organizational consumption per mile of displacement multiplied by the average round trip supply distance. When the organization is not on the move, supply haul requirements are included in the composite requirement described in (4) below and are not computed separately.

(3) *Service.* Supplemental daily requirements exist for such purposes as movement of vehicles within bivouac areas and on reconnaissance, warming up engines, and abnormal periods of low-gear operation. These items will differ with the character of the operation, weather, roads, and terrain, and must be estimated in accordance with general conditions. Under average conditions, these requirements can be estimated by using the consumption necessary to move all vehicles in the organization 10 miles over roads. This factor applies when the organization is on the march or in combat.

(4) *Housekeeping.* Additional daily requirements exist for administrative vehicles, kitchens, gasoline-powered equipment, and maintenance and testing of engines. When the organization is not on the march, these requirements are grouped in a composite daily requirement as noted under each gasoline and oil supply data table. When the organization is on the move, the requirements for administrative vehicles

(not supply hauls) and gasoline-powered equipment are absorbed by displacement requirements; the maintenance and testing factor is absorbed by the service factor; but the kitchen requirement must be added on the basis of a daily consumption per kitchen of 15 gallons of gasoline.

- (5) *Wastage.* This factor covers evaporation, spillage, and small combat losses. It is applied only to road movement in the combat zone. It is computed as 10 percent of the sum of all other consumption figures.

Caution: Refer to notes at foot of gasoline and oil supply data tables (pars. 5.17-5.23) for supplemental information and data necessary to

determine complete solutions of estimated requirements.

Example: An armored division (par. 5.18) is to make the following movement: 1st day—90 miles in communications zone to bivouac area at army rear boundary; 2d day—no movement; 3d day—60 miles forward in combat zone; and 4th day—10 miles, with 8 miles under cross-country battle conditions for all elements except the division trains. Average round trip supply distances are: 1st day—30 miles; 2d day—20 miles; 3d day—40 miles; and 4th day—30 miles. Estimate gasoline requirements for the 4-day period.

1st day		
(a)	Multiply 90 (displacement) by 2,124 (gal per mile) -----	= 191,160
(b)	Multiply 30 (supply distance) by 212 (10% of division consumption per mile) -----	= 6,360
(c)	Multiply 10 by 2,124 to account for service requirements -----	= 21,240
(d)	Multiply 15 (gal) by 98 (organic kitchens) -----	= 1,470

2d day		
(e)	From footnote 1, paragraph 5.18 -----	= 2,000

3d day		
(f)	Multiply 80 (displacement) by 2,124 (gal per mile) -----	= 169,920
(g)	Multiply 40 (supply distance) by 212 (10% of division consumption per mile) -----	= 8,480
(h)	Multiply 10 by 2,124 to account for service requirements -----	= 21,240
(i)	Multiply 15 (gal) by 98 (organic kitchens) -----	= 1,470
(j)	Take 10% of (f) + (g) + (h) + (i) to account for wastage -----	= 20,963

4th day		
(k)	Multiply 2 (road displacement) by 2,124 (gal per mile) -----	= 4,248
(l)	Multiply 8 (road displacement) by 93 (gal per mile for division trains) -----	= 744
(m)	Multiply 8 (cross-country battle displacement) by 2,031 (gal per mile for combat units) by 2.5 (cross-country battle factor) -----	= 40,620
(n)	Multiply 30 (supply distance) by 212 (10% of division consumption per mile) -----	= 6,360
(o)	Multiply 10 by 2,124 to account for service requirements -----	= 21,240
(p)	Multiply 15 (gal) by 98 (organic kitchens) -----	= 1,470
(q)	Take 10% of (k) + (l) + (n) + (o) + (p) to account for wastage -----	= 4,041
(r)	Total estimate for 4 days—add (a) through (q) -----	= 523,026
		or 523,000 gallons

- (6) *Computing aviation fuel requirements.*
Aviation fuel requirements are com-

puted separately for each type aircraft by the following formula:

$$\frac{\text{No. acft by type} \times \text{avg consumption/hr in gal} \times \text{dis to be flown}}{\text{Avg speed of acft}} = \text{Total fuel rqr by type acft}$$

5.17. Gasoline and Oil Supply Data—Airborne Division (ROTAD)

1	2	3	4	5	6	7	8	9	10	11	12
Unit	Fuel and lubricant requirements, motor vehicles consumption in moving unit 100 miles				Gasoline capacity (gal)			Fuel drum data, number of organic 5-gallon fuel drums			
	Vehicle fuel (gal)	Engine oil (gal)	Gear lubrication (lb)	Grease, miscellaneous (lb)	Vehicle tanks	Drums, 5-gal	Total	Resupply, kitchen, airplane, and miscellaneous	Motor vehicles	Total	Organic kitchens
2 Comd and con bn (total)-----	1,238.9	27.6	36.3	31.5	2,701	3,990	6,691	626	172	798	6
3 Hq & Hq co-----	(366.0)	(9.2)	(10.6)	(9.8)	(847)	(375)	(1,222)	(24)	(51)	(75)	(2)
4 Admin co-----	(158.1)	(3.8)	(5.4)	(3.8)	(287)	(290)	(577)	(39)	(19)	(58)	(2)
5 Avn co-----	(357.3)	(6.4)	(9.9)	(8.7)	(752)	(2,180)	(2,932)	(381)	(55)	(436)	(1)
6 Cav trp-----	(357.5)	(8.2)	(10.4)	(9.2)	(815)	(1,145)	(1,960)	(182)	(47)	(229)	(1)
7 5 abn BG (total)-----	1,641.7	71.8	58.5	49.7	2,991	1,235	4,226	126	121	247	35
8 Hq & Hq co-----	(752.5)	(43.4)	(29.1)	(20.3)	(1,452)	(460)	(1,912)	(18)	(74)	(92)	(1)
9 Mort btry, 105-mm-----	(307.2)	(8.4)	(9.4)	(9.4)	(559)	(300)	(859)	(33)	(27)	(60)	(1)
10 5 rifle co (total)-----	(582.0)	(20.0)	(20.0)	(20.0)	(980)	(475)	(1,455)	(75)	(20)	(95)	(5)
11 Engr bn (total)-----	2,462.6	52.6	81.8	50.7	3,806	1,485	5,291	228	69	297	3
12 Hq & Hq co-----	(1,783.6)	(35.2)	(63.0)	(33.9)	(2,664)	(955)	(3,619)	(148)	(43)	(191)	(1)
13 2 engr co (total)-----	(679.0)	(17.4)	(18.8)	(16.8)	(1,142)	(530)	(1,672)	(80)	(26)	(106)	(2)
14 Spt gp (total)-----	2,800.6	59.0	93.2	64.9	6,504	7,445	13,949	1,143	346	1,489	7
15 Hq & Hq co-----	(93.7)	(2.2)	(2.8)	(2.4)	(217)	(115)	(332)	(10)	(13)	(23)	(1)
16 QM preht sup co-----	(150.2)	(3.0)	(5.3)	(3.3)	(356)	(250)	(606)	(32)	(18)	(50)	(1)
17 Maint bn (total)-----	(1,121.9)	(22.6)	(34.7)	(26.4)	(2,499)	(980)	(3,479)	(49)	(147)	(196)	(2)
18 Hq & main spt co-----	(372.1)	(8.4)	(13.2)	(8.1)	(886)	(405)	(1,291)	(45)	(36)	(81)	(1)
19 Emerg rep co-----	(749.8)	(14.2)	(21.5)	(18.3)	(1,613)	(575)	(2,188)	(6)	(109)	(115)	(1)
20 Sup and trans co-----	(918.4)	(18.8)	(35.6)	(19.2)	(2,246)	(5,540)	(7,786)	(1,010)	(98)	(1,108)	(1)
21 Med co-----	(516.4)	(12.4)	(14.8)	(13.6)	(1,186)	(560)	(1,746)	(38)	(74)	(112)	(2)
22 Sig bn (total)-----	793.6	14.8	21.0	20.2	1,623	1,045	2,668	86	123	209	2
23 Hq & Hq det-----	(48.0)	(.8)	(1.2)	(1.2)	(96)	(90)	(186)	(10)	(8)	(18)	(0)
24 Comd op co-----	(450.1)	(8.6)	(12.0)	(11.6)	(1,012)	(510)	(1,522)	(34)	(68)	(102)	(1)
25 Fwd comm co-----	(295.5)	(5.4)	(7.8)	(7.4)	(615)	(445)	(1,060)	(42)	(47)	(89)	(1)
26 Div arty (total)-----	2,271.9	48.0	60.1	52.1	5,098	1,900	6,998	88	292	380	7
27 Hq & Hq btry-----	(493.3)	(10.4)	(15.5)	(11.9)	(1,132)	(450)	(1,582)	(24)	(66)	(90)	(1)
28 5 FA how btry, 105-mm (total).-----	(948.5)	(19.0)	(26.0)	(24.0)	(2,045)	(825)	(2,870)	(20)	(145)	(165)	(5)
29 FA msl btry, 762-mm rkt-----	(830.1)	(18.6)	(18.6)	(16.2)	(1,929)	(625)	(2,554)	(44)	(81)	(125)	(1)
30 Total—division-----	17,776.1	508.4	503.1	417.2	34,687	22,040	56,727	2,801	1,607	4,408	60

5.18. Gasoline and Oil Supply Data—Armored Division (ROCAD)^{1 2 3 4 5 6}

	1	2	3	4	5	6	7	8	9	10	11	12	13
	Unit	Fuel and lubricant requirements—motor vehicles Consumption in moving vehicles 100 miles				Gasoline capacity (gal)				Fuel drum data Organic fuel drums			Organic kitchens
		Vehicle fuel (gal)	Engine oil (gal)	Lubricant (lb)	Misc greases (lb)	Vehicle tanks	Drums, 5-gal	Bulk tankers	Total	Airplane, kitchen, and misc	Motor vehicles	Total	
1	Hq & Hq co, armd div	1,058	26.5	15.1	17.2	1,762	420	-----	2,182	26	58	84	2
2	3 Hq & Hq co, CC (total)	4,236	139.2	80.4	89.4	5,562	3,660	-----	3,222	618	114	732	3
3	Avn co	469	15.6	8.2	9.1	1,214	500	4,800	6,514	26	74	100	1
4	MP co	414	12.3	6.3	6.6	1,036	325	-----	1,361	5	60	65	1
5	Sig bn (total)	2,098	66.6	37.3	43.3	5,401	2,035	1,200	8,636	166	241	407	3
6	Hq & Hq co	(665)	(20.6)	(11.6)	(14.3)	(1,982)	(745)	(1,200)	(3,927)	(69)	(80)	(149)	(1)
7	Comd op co	(946)	(29.8)	(17.1)	(19.4)	(2,157)	(745)	-----	(2,902)	(58)	(91)	(149)	(1)
8	Fwd comm co	(487)	(16.2)	(8.6)	(9.6)	(1,262)	(545)	-----	(1,807)	(39)	(70)	(109)	(1)
9	Cav sq (total)	18,336	396.6	227.5	254.5	18,431	13,770	9,600	41,801	2,501	253	2,754	5
10	Hq & Hq trp	(3,176)	(81.0)	(45.9)	(52.5)	(4,935)	(13,230)	(9,600)	(27,765)	(2,497)	(149)	(2,646)	(1)
11	4 recon trp (total)	(15,160)	(315.6)	(171.6)	(202.0)	(13,496)	(540)	-----	(14,036)	(4)	(104)	(108)	(4)
12	Engr bn (total)	11,285	358.3	208.4	238.4	17,950	2,725	3,600	24,275	289	256	545	6
13	Hq & Hq co	(1,807)	(49.2)	(28.1)	(33.7)	(3,620)	(800)	(3,600)	(8,020)	(56)	(104)	(160)	(1)
14	4 engr co (total)	(8,364)	(272.8)	(161.6)	(181.2)	(10,736)	(980)	-----	(11,716)	(76)	(120)	(196)	(4)
15	Brg co	(1,114)	(36.2)	(18.7)	(23.5)	(3,594)	(945)	-----	(4,539)	(157)	(32)	(189)	(1)
16	4 armd inf bn (total)	44,644	1,288.4	784	842.8	59,524	28,560	19,200	107,284	5,060	652	5,712	20
17	Hq & Hq co	(2,757)	(78.5)	(45.6)	(50.7)	(4,649)	(6,940)	(4,800)	(16,389)	(1,257)	(131)	(1,388)	(1)
18	4 rifle co (total)	(8,404)	(243.6)	(150.4)	(160)	(10,232)	(200)	-----	(10,432)	(8)	(32)	(40)	(4)
19	4 armor bn, 90-mm (total)	96,928	2,523.6	1,839.2	2,178.8	89,764	52,180	38,400	180,344	9,600	836	10,436	20
20	Hq & Hq co	(4,136)	(127.3)	(72.6)	(82.7)	(6,477)	(12,885)	(9,600)	(28,962)	(2,396)	(181)	(2,577)	(1)
21	4 med tk co, 90-mm (total)	(20,096)	(603.6)	(397.2)	(462.0)	(16,964)	(160)	-----	(16,124)	(4)	(28)	(32)	(4)
22	Div arty	23,633	719	405	463.1	34,190	18,405	9,600	62,195	2,759	922	3,681	22
23	Hq & Hq btry	(841)	(26.2)	(15)	(16.7)	(1,830)	(550)	-----	(2,380)	(34)	(76)	(110)	(1)
24	3 FA how bn, 105-mm, SP (total)	(16,155)	(489.9)	(276)	(315.3)	(22,815)	(12,095)	(7,200)	(43,110)	(2,046)	(373)	(2,619)	(15)
25	Hq & Hq btry	(1,109)	(34.3)	(20.3)	(21.7)	(1,786)	(435)	-----	(2,221)	(31)	(56)	(87)	(1)
26	3 FA how btry, 105-mm, SP (total)	(3,384)	(107.4)	(60)	(69)	(4,158)	(510)	-----	(4,668)	(24)	(78)	(102)	(3)
27	Svc btry	(892)	(21.6)	(11.7)	(14.4)	(1,661)	(3,420)	(2,400)	(7,481)	(627)	(57)	(684)	(1)
28	FA comp bn (total)	(6,637)	(202.9)	(114)	(131.1)	(9,545)	(4,760)	(2,400)	(16,705)	(679)	(273)	(952)	(6)
29	Hq & Hq btry	(715)	(22.5)	(13.3)	(14.2)	(1,272)	(330)	-----	(1,602)	(20)	(46)	(66)	(1)
30	2 FA how btry, 155-mm, SP (total)	(3,306)	(105.6)	(58.4)	(68.6)	(3,894)	(460)	-----	(4,354)	(14)	(78)	(92)	(2)
31	FA how btry, 8-in., SP	(1,388)	(42.2)	(24)	(27.3)	(1,862)	(205)	-----	(2,067)	(7)	(34)	(41)	(1)
32	FA msl btry, 762-mm rkt, SP	(384)	(12.6)	(6.6)	(7.8)	(1,112)	(385)	-----	(1,497)	(11)	(66)	(77)	(1)
33	Svc btry	(844)	(20)	(10.7)	(13.2)	(1,405)	(3,380)	(2,400)	(7,185)	(627)	(49)	(676)	(1)
34	Div trains	9,264	276.6	154.2	187.4	23,262	22,625	96,000	141,887	3,517	1,008	4,525	15
35	Hq & Hq det & band	(101)	(3.1)	(1.7)	(2)	(284)	(120)	-----	(404)	(10)	(14)	(24)	(1)

36	Admin co.....	(176)	(5.3)	(3)	(3.7)	(525)	(320)	-----	(845)	(41)	(23)	(64)	(3)
37	Med bn (total).....	(1,119)	(35.8)	(19.3)	(22.1)	(3,021)	(1,425)	-----	(4,446)	(120)	(165)	(285)	(5)
38	Hq & Hq det.....	(218)	(6.6)	(3.7)	(4.5)	(639)	(220)	-----	(859)	(15)	(29)	(44)	(1)
39	Amb co.....	(516)	(17.5)	(8.8)	(8.9)	(1,181)	(445)	-----	(1,626)	(2)	(87)	(89)	-----
40	Clr co.....	(385)	(11.7)	(6.8)	(8.7)	(1,201)	(760)	-----	(1,961)	(103)	(49)	(152)	(4)
41	Ord bn (total).....	(4,844)	(136)	(78.7)	(94.7)	(9,817)	(3,225)	-----	(13,042)	(288)	(357)	(645)	(4)
42	Hq & main spt co.....	(1,682)	(49.3)	(27.7)	(33.8)	(3,469)	(1,050)	-----	(4,519)	(39)	(171)	(210)	(1)
43	3 fwd spt co (total).....	(3,162)	(86.7)	(51)	(60.9)	(6,338)	(2,175)	-----	(8,523)	(249)	(186)	(435)	(3)
44	QM bn (total).....	(3,024)	(96.4)	(51.5)	(64.9)	(9,615)	(17,535)	(96,000)	(123,150)	(3,058)	(449)	(3,507)	(2)
45	Hq & Hq det.....	(79)	(2.6)	(1.3)	(1.3)	(181)	(130)	-----	(311)	(13)	(13)	(26)	-----
46	Sup co.....	(1,505)	(46.1)	(26)	(34.8)	(4,895)	(16,070)	(96,000)	(116,965)	(3,013)	(201)	(3,214)	(1)
47	Fld svc co.....	(1,440)	(47.7)	(24.2)	(29.8)	(4,539)	(1,335)	-----	(5,874)	(32)	(235)	(267)	(1)
48	Total—division.....	212,365	6,622.7	3,805.6	4,330.6	258,096	145,205	182,400	585,701	24,567	4,474	29,041	98

¹ When the division is not on the march, 2,000 gallons of fuel per day are required for administrative vehicles, kitchens, and gasoline-powered equipment. This figure includes the warmup factor.

² When figured separately, daily gasoline consumption for each kitchen is 15 gallons.

³ For cross-country battle conditions, fuel and lubricant consumption figures are multiplied by 2.5. (The 10 percent handling factor need not be applied when this factor is used.)

⁴ When tent stove is issued, add 236 drums (5-gallon capacity), on the basis of 1 drum per tent stove.

⁵ Data contained in this table are recommended for planning purposes only. The data are under development and subject to continuing revision.

⁶ Data for medical detachments are included in respective battalion headquarters and headquarters company figures.

5.19. Gasoline and Oil Supply Data—Infantry Division (ROCID)^{1 2 3 4}

	1	2	3	4	5	6	7	8	9	10	11	12
1	Unit	Fuel and lubricant requirements, motor vehicles consumption in moving unit 100 miles				Gasoline capacity (gal)			Fuel drum data, number of organic 5-gallon fuel drums			
		Vehicle fuel (gal)	Engine oil (gal)	Gear lubrication (lb)	Grease, miscellaneous (lb)	Vehicle tanks	Drums, 5-gal	Total	Resupply, kitchen, airplane, and miscellaneous	Motor vehicles	Total	Organic kitchens
2	Hq & Hq co, inf div	431.5	11.0	12.4	11.6	1,009	305	1,314	28	61	89	1
3	5 BG (total)	15,411	311	307	231	23,730	4,700	28,430	205	940	1,145	30
4	Hq & Hq co	(12,110.5)	(251)	(219.5)	(145.5)	(16,645)	(2,325)	(18,970)	(140)	(465)	(605)	(5)
5	4 rifle co (total)	(1,812)	(40)	(48)	(48)	(3,960)	(1,200)	(5,160)	(20)	(240)	(260)	(20)
6	Mort btry, 105-mm	(1,488.5)	(28)	(39.5)	(37.5)	(3,125)	(1,175)	(4,300)	(45)	(235)	(280)	(5)
7	Armor bn, 90-mm (total)	32,471.6	574.8	262.4	172.8	26,891	590	27,481	1,924	118	2,042	6
8	Hq & Hq co	(3,775.6)	(73.8)	(52.9)	(48.3)	(5,196)	(540)	(5,736)	(1,919)	(108)	(2,027)	(1)
9	5 med tk co, 90-mm (total)	(28,696)	(501)	(209.5)	(124.5)	(21,695)	(50)	(21,745)	(5)	(10)	(15)	(5)
10	Cav sq (total)	7,880.6	193.5	185.2	135.2	10,861	675	11,536	1,899	135	2,034	4
11	Hq & Hq trp	(2,126.9)	(44.4)	(43.3)	(36.5)	(3,286)	(375)	(3,661)	(1,896)	(75)	(1,971)	(1)
12	3 recon trp (total)	(5,753.7)	(149.1)	(141.9)	(98.7)	(7,575)	(300)	(7,875)	(3)	(60)	(63)	(3)
13	Engr bn (total)	4,416.7	83.7	88.3	55.1	4,093	1,160	5,253	329	232	561	6
14	Hq & Hq co	(3,017.2)	(53.7)	(43.8)	(27.6)	(2,713)	(485)	(3,198)	(154)	(97)	(251)	(1)
15	5 engr co (total)	(1,399.5)	(30.0)	(44.5)	(27.5)	(1,380)	(675)	(2,055)	(175)	(135)	(310)	(5)
16	Sig bn (total)	2,106.9	40.2	68.9	47.4	4,800	1,370	6,170	161	274	435	3
17	Hq & Hq co	(599.0)	(12.2)	(21.0)	(12.7)	(1,439)	(335)	(1,774)	(50)	(67)	(117)	(1)
18	Comd op co	(815.0)	(15.8)	(27.2)	(18.4)	(1,877)	(525)	(2,402)	(58)	(105)	(163)	(1)
19	Fwd comm co	(692.0)	(12.2)	(20.7)	(16.3)	(1,484)	(510)	(1,994)	(53)	(102)	(155)	(1)
20	Div arty (total)	7,554.5	179.8	169.0	165.2	16,014	3,010	19,024	1,644	602	2,246	14
21	Hq & Hq btry	(637.6)	(13.0)	(21.1)	(14.7)	(1,410)	(410)	(1,820)	(41)	(82)	(123)	(1)
22	FA how bn, 105-mm, towed (total)	(2,638.9)	(55.2)	(74.3)	(57.1)	(6,063)	(1,555)	(7,618)	(735)	(311)	(1,046)	(7)
	Hq & Hq btry	(303.9)	(6.0)	(8.7)	(7.5)	(653)	(225)	(878)	(21)	(45)	(66)	(1)
23	5 FA how btry, 105-mm, towed (total)	(1,917)	(40.0)	(55.0)	(42.0)	(4,410)	(1,150)	(5,560)	(75)	(230)	(305)	(5)
24	Svc btry	(418)	(9.2)	(10.6)	(7.6)	(1,000)	(180)	(1,180)	(639)	(36)	(675)	(1)
25	FA comp bn (total)	(4,278.0)	(111.6)	(73.6)	(93.4)	(8,541)	(1,045)	(9,586)	(868)	(209)	(1,077)	(6)
26	Hq & Hq btry	(303.9)	(6.0)	(8.7)	(7.5)	(653)	(225)	(878)	(21)	(45)	(66)	(1)
27	2 FA how btry, 155-mm, towed (total)	(1,926.4)	(54.8)	(26.8)	(44.6)	(3,658)	(230)	(3,888)	(122)	(46)	(168)	(2)
28	FA how btry, 8-in., towed	(786.5)	(4.4)	(12.4)	(17.6)	(1,537)	(145)	(1,682)	(47)	(29)	(76)	(1)
29	FA msl btry, 762-mm rkt, SP.	(483.3)	(10.4)	(11.7)	(9.5)	(1,109)	(245)	(1,354)	(25)	(49)	(74)	(1)
30	Svc btry	(777.9)	(19.0)	(14.0)	(14.2)	(1,584)	(200)	(1,784)	(653)	(40)	(693)	(1)
31	Div trains	22,131.3	381.4	325.7	383.5	31,609	3,705	35,314	1,662	717	2,379	15
32												

33	Hq & Hq det & band.....	(111.5)	(2.4)	(3.5)	(2.7)	(257)	(75)	(332)	(10)	(15)	(25)	(1)
34	QM co ⁵	(1,141.1)	(23.2)	(37.1)	(22.9)	(2,729)	(595)	(3,324)	(1,259)	(119)	(1,378)	(1)
35	Med bn (total).....	(662.1)	(12.2)	(18.0)	(16.4)	(1,395)	(515)	(1,910)	(96)	(103)	(199)	(4)
36	Hq & Hq det.....	(98.6)	(2.2)	(2.9)	(2.5)	(224)	(70)	(294)	(17)	(14)	(31)	(1)
37	Amb co.....	(460.4)	(8.0)	(11.6)	(11.6)	(932)	(380)	(1,312)	(3)	(76)	(79)	-----
38	Clr co.....	(103.1)	(2.0)	(3.5)	(2.3)	(239)	(65)	(304)	(76)	(13)	(89)	(3)
39	Ord bn (total).....	(2,693)	(52.0)	(59.7)	(47.6)	(4,768)	(815)	(5,583)	(206)	(163)	(369)	(2)
40	Hq & maint spt co.....	(942)	(18.4)	(26.6)	(16.9)	(1,939)	(385)	(2,324)	(50)	(77)	(127)	(1)
41	Fwd spt co.....	(1,751)	(33.6)	(33.1)	(30.7)	(2,829)	(430)	(3,259)	(156)	(86)	(242)	(1)
42	Avn co.....	(434.1)	(8.2)	(11.8)	(10.3)	(912)	(310)	(1,222)	(28)	(62)	(90)	(1)
43	Admin co.....	(159.5)	(3.4)	(5.6)	(3.6)	(383)	(95)	(478)	(39)	(19)	(58)	(2)
44	Trans bn (total).....	(16,930)	(280)	(190)	(280)	(21,165)	(1,300)	(22,465)	(24)	(236)	(260)	(4)
45	Hq & Hq co.....	(695)	(15)	(15)	(15)	(1,200)	(420)	(1,620)	(12)	(72)	(84)	(1)
46	Trk trans co.....	(1,405)	(35)	(65)	(35)	(4,565)	(840)	(5,405)	(4)	(164)	(168)	(1)
47	2 armd carr co (total).....	(14,830)	(230)	(110)	(230)	(15,400)	(40)	(15,440)	(8)	-----	(8)	(2)
48	Total—division.....	92,404.1	1,775.4	1,418.9	1,201.8	119,007	15,515	193,122	7,852	3,079	10,931	79

¹When the division is not on the march approximately 4,000 gallons of fuel per day are required for administrative vehicles, kitchens, and gasoline-powered equipment. This figure includes wastage and warmup factors.

²When figured separately, daily gasoline consumption per kitchen is 15 gallons.

³For cross-country battle conditions, vehicle fuel and lubricant consumption figures are multiplied by 2.5 (The 10 percent wastage factors need not be applied when this factor is used.)

⁴Includes allowances for tent stoves.

⁵Tank truck capacity of 58,600 gallons.

5.20. Gasoline and Oil Supply Data—Armored Units^{1 2 3 4}

	1	2	3	4	5	6	7	8	9	10	11	12
	Unit	Fuel and lubricant requirements, motor vehicles consumption in moving unit 100 miles				Gasoline capacity (gal)			Fuel drum data, number of organic 5-gallon fuel drums			Organic kitchens
1		Vehicle fuel (gal)	Engine oil (gal)	Gear lubrication (lb)	Grease, miscellaneous (lb)	Vehicle tanks	Drums, 5-gal	Total	Resupply, kitchen, airplane, and miscellaneous	Motor vehicles	Total	
2	Hq & Hq co, armor gp-----	174	4.4	6.9	4.5	477	390	867	45	13	58	1
3	Tk bn, 90-mm gun (nondiv)---	26,865	423.8	164.2	228.7	24,307	11,140	35,447	2,152	76	2,228	-----
4	Armd cav regt-----	42,112	902.5	559.8	599.6	49,192	42,390	91,582	8,111	367	8,478	20
5	Hq & Hq co-----	(1,194)	(28.1)	(26.4)	(26.4)	(2,118)	(1,290)	(3,408)	(177)	(81)	(258)	(1)
6	Svc co-----	(2,350)	(54.8)	(126.3)	(42.2)	(5,053)	(38,505)	(43,558)	(7,613)	(88)	(7,701)	(1)
7	3 recon sq (ea)-----	(12,856)	(273.2)	(135.7)	(177)	(14,007)	(865)	(14,872)	(51)	(122)	(173)	(6)
8	Hq & Hq trp-----	(802)	(18.2)	(14.3)	(17.7)	(1,275)	(260)	(1,535)	(23)	(29)	(52)	(1)
9	3 recon trp (ea)-----	(1,854)	(44.9)	(20.7)	(36.4)	(2,327)	(160)	(2,487)	(7)	(25)	(32)	(1)
10	Tk co, 90-mm gun-----	(5,328)	(93.9)	(39)	(23.2)	(4,129)	(35)	(4,164)	(2)	(5)	(7)	(1)
11	How co-----	(1,164)	(26.4)	(20.3)	(26.9)	(1,622)	(90)	(1,712)	(5)	(13)	(18)	(1)
12	Amph tk bn-----	6,587	319.2	148.1	270.4	10,476	690	11,166	10	128	138	5
13	Hq, H&S co-----	(1,267)	(46)	(31.3)	(48.8)	(2,240)	(170)	(2,410)	(2)	(32)	(34)	(1)
14	4 amph tk co (ea)-----	(1,330)	(54.8)	(29.2)	(55.4)	(2,059)	(130)	(2,189)	(2)	(24)	(26)	(1)
15	Amph trac bn-----	8,319	315.1	185.2	348.8	13,085	815	13,900	14	149	163	3
16	Hq, H&S co-----	(1,047)	(36.5)	(26.6)	(39.6)	(1,905)	(215)	(2,120)	(2)	(41)	(43)	(1)
17	2 amph trac co (ea)-----	(3,636)	(139.3)	(79.3)	(154.6)	(5,590)	(300)	(5,890)	(6)	(54)	(60)	(1)
18	Recon sq-----	11,735	256.2	136.4	159.8	12,939	5,895	18,834	1,045	134	1,179	5

¹ Refer to paragraph 5.16b.

² For kitchens, estimated daily requirement, 15 gallons.

³ Data contained in this table are recommended for planning purposes only. The data are under development and subject to continuing revision.

⁴ Data for medical detachments are included in respective headquarters, headquarters and service company.

5.21. Gasoline and Oil Supply Data—Artillery Units

a. Field Artillery ^{1 2 3} (Nondivisional).

	1	2	3	4	5	6	7	8	9	10	11	12
1	Unit	Fuel and lubricant requirements—motor vehicles									Organic kitchens	
		Consumption in moving unit 100 miles				Gasoline capacity—gallons fuel to fill tanks			Fuel can data—organic fuel drums			
		Vehicle fuel (gal)	Engine oil (gal)	Gear lubri- cation (lb)	Grease misc (lb)	Vehicle tanks	Drums, 5-gal	Total	Aircraft, kitchens, and misc	Motor vehicles		Total
2	Hq & Hq btry, corps arty-----	570	12.8	19.5	14.7	1,413	655	2,068	50	81	131	1
3	Hq & Hq btry, FA gp-----	330	7.6	11.4	8.6	828	375	1,203	27	48	75	1
4	FA obsn bn-----	2,122	49.8	77.2	54.9	5,427	1,725	7,152	7	338	345	4
5	FA bn, 105-mm how, towed-----	1,669	36.8	63	39.9	4,304	1,910	6,214	164	218	382	5
6	Armd FA bn, 105-mm how, SP-----	3,164	66.3	73.3	76.3	6,090	4,530	10,620	769	137	906	5
7	FA bn, 155-mm how, towed-----	2,670	75.9	86.9	80.9	5,337	2,725	8,062	164	381	545	5
8	Armd FA bn, 155-mm how, SP-----	5,586	145.3	116	125.6	8,718	4,540	13,258	763	145	908	5
9	FA bn, 155-mm gun or 8-in. how, towed-----	3,121	80.4	66.9	77.2	7,487	4,365	11,852	485	388	873	5
10	FA bn, 155-mm gun or 8-in. how, SP-----	4,139	98	69.2	76.8	7,464	3,645	11,109	487	242	729	5
11	FA btry, slt-----	384	10.2	19.3	10.9	1,072	405	1,477	5	76	81	1
12	FA bn, 280-mm gun ⁴ -----	3,418	51.4	75.8	50.2	7,397	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)

¹ When experience factors are not available, use 400 gallons fuel per day for miscellaneous small fuel-consuming devices.

² Includes medical detachment.

³ Average daily gasoline consumption (net) is 15 gallons per kitchen.

⁴ Does not include consumption of oil, gear lubrication, and grease for transporter, heavy artillery. Does not include diesel tractors.

⁵ Data not available.

b. Air Defense Artillery ^{1 2 3} (Nondivisional).

	1	2	3	4	5	6	7	8	9	10	11	12
1	Unit	Fuel and lubricant requirements—motor vehicles										Organic kitchens
		Consumption in moving unit 100 miles				Gasoline capacity—gallons fuel to fill tanks			Fuel can data—organic fuel drums			
		Vehicle fuel (gal)	Engine oil (gal)	Gear lubri- cation (lb)	Grease misc (lb)	Vehicle tanks	Drums, 5-gal	Total	Aircraft, kitchens, and misc	Motor vehicles	Total	
2	AAA det, op.....	126	2.8	5	3	332	110	442	6	16	22	1
3	Hq & Hq btry, AAA gp.....	282.8	6.6	11	7	745	235	980	10	37	47	1
4	AAA bn, 90-mm gun.....	2,672.8	103.8	100.2	94.3	8,730	1,400	10,130	31	249	280	5
5	AAA bn, AW, mbl.....	2,329	51	94	53.7	6,171	1,795	7,966	70	289	359	5
6	AAA bn, 75-mm gun, mbl.....	3,433	96	69.6	81.6	6,956	1,560	8,516	27	285	312	4
7	AAA bn, AW, SP.....	6,371	155.7	104.8	184	8,308	2,470	10,778	361	133	494	5
8	Hq & Hq btry, AAA bde.....	319.8	7.8	13.2	8.0	871	275	1,146	14	41	55	1
9	AAA bn, 120-mm gun.....	2,566.8	34.6	41.8	32.4	3,898	795	4,693	32	127	159	5
10	AAA bn, AW, smbl.....	799	18.6	29.2	19.7	2,073	855	2,928	66	105	171	5
11	AD arty msl bn, NIKE-AJAX.....	3,621	76.6	112.2	70.2	10,247	2,930	13,177	241	345	586	5

¹ Fuel for operations of generators, etc., must be computed separately.² Includes medical detachment.³ Average daily gasoline consumption (net) is 15 gallons per kitchen.

5.22. Gasoline and Oil Supply Data—Chemical Units

	1	2	3	4	5	6	7	8	9	10	11	12
1	Unit	Fuel and lubricant requirements—motor vehicles										Organic kitchens
		Consumption in moving unit 100 miles				Gasoline capacity—gallons fuel to fill tanks			Fuel can data—organic fuel drums			
		Vehicle fuel (gal)	Engine oil (gal)	Gear lubri- cation (lb)	Grease misc (lb)	Vehicle tanks	Drums, 5-gal (all)	Total	Kitchens and misc	Motor vehicles	Total	
2	Cml dep co.....	291	5.8	10.8	6.4	560	155	715	5	26	31	1
3	Cml maint co.....	182	4.2	4.9	4.2	415	115	530	1	22	23	1
4	Cml decon co.....	337	7.6	14.4	7.6	740	220	960	3	41	44	-----
5	Hq & Hq det, cml smoke genr bn.....	57	1.1	1.8	1.4	130	55	185	3	8	11	1
6	Cml smoke genr co ¹	522	13.0	19.0	13.0	1,155	2,750	3,905	482	67	559	1
7	Hq & Hq det, cml gp (fld).....	66	1.7	2.1	1.7	145	55	200	4	7	11	-----
8	Hq & Hq det, cml bn (svc).....	59	1.5	1.9	1.5	130	50	180	4	6	10	-----
9	Cml co, cmbt spt.....	864	20.4	30.8	20.4	1,970	570	2,540	3	114	117	1

¹ Basic load of 52.7 tons of fog oil and 3 tons of gasoline (class III supplies) as fuel for mechanical smoke generator operation (par. 5.36).

5.23. Gasoline and Oil Supply Data—Selected Services Units*

	1	2	3	4	5	6	7	8	9	10	11	12
1	Unit	Fuel and lubricant requirements—motor vehicles										Organic kitchens
		Consumption in moving unit 100 miles				Gasoline capacity—gallons fuel to fill tanks			Fuel can data—organic fuel drums			
		Vehicle fuel (gal)	Engine oil (gal)	Gear lubri- cation (lb)	Grease misc (lb)	Vehicle tanks	Drums, 5-gal	Total	Aircraft, kitchens, and misc	Motor vehicles	Total	
2	Engr dp trk co.....	2,050	31.9	61.4	41.6	3,180	575	3,755	5	110	115	1
3	Engr pnl brg co.....	1,090	23.4	43.4	23.6	2,340	645	2,985	8	121	129	1
4	Engr pon brg co.....	1,945	37.5	69.6	40.0	3,755	1,110	4,865	13	209	222	1
5	Engr float brg co.....	2,525	54.1	63.6	58.0	4,840	1,370	6,210	18	256	274	1
6	Med amb co (sep).....	455	11.0	12.2	11.0	1,080	370	1,450	4	70	74	1
7	Trans amph trk co.....	915	28.9	43.0	17.9	2,100	580	2,680	9	107	116	1
8	Trans trk co (lt).....	1,150	25.0	50.0	25.0	3,690	730	4,420	12	134	146	1
9	Trans trk co (med).....	2,160	40.0	55.0	50.0	6,930	735	7,665	13	134	147	1
10	Trans trk co (hv).....	2,570	40.0	25.0	30.0	3,000	1,345	4,345	9	260	269	1
11	Trans cargo carr co (tracked).....	1,620	120.0	45.0	80.0	3,240	2,730	5,970	6	540	546	1
12	Trans car co.....	700	15.0	15.0	15.0	1,450	520	1,970	11	93	104	1
13	Hq & Hq co, trans trk bn.....	75	1.0	1.0	1.0	235	130	365	13	13	26	1
14	Hq & Hq co, trans trk gp.....	120	2.0	2.0	2.0	290	115	405	8	15	23	1
15	Hq & Hq co, trans hwy trans comd.....	110	3.0	3.0	3.0	300	155	455	9	22	31	1
16	Hq & Hq det, QM gp.....	69	.1	.2	.1	168	75	243	7	8	15	1
17	Sig bn, corps.....	3,929	83.0	187.9	94.4	11,533	4,580	16,113	383	523	916	6
18	Hq & Hq co.....	659	13.6	20.8	15.5	2,022	420	2,442	11	73	84	1
19	Rad & msg cen op co.....	590	13.6	23.0	14.4	2,664	640	3,304	46	72	128	1
20	Wire & rad rel op co.....	916	19.2	82.0	21.6	2,239	1,495	3,734	191	108	299	1
21	3 sig cons co (total).....	1,764	36.6	62.1	42.9	4,608	2,025	6,633	135	270	405	3

*Average daily connection (net) is 15 gallons per kitchen.

Section V. CLASS V SUPPLY

5.24. Definitions and Responsibilities

a. Basic Load. A basic load of ammunition is a prescribed allowance of ammunition authorized and required to be in possession of a unit. It is expressed in terms of rounds for ammunition fired by weapons and in other units of measure for bulk allotment items. It includes ammunition carried by the individual soldier, the ammunition stowed in self-propelled weapons, and the ammunition carried in prime movers and in unit trains. This authorized amount of ammunition will normally sustain a unit in combat until resupply can be effected. It is established by the Department of the Army, based on recommendations of theater commanders. In wartime, it is normally requisitioned by and issued to all units located in an active theater, and such other units as may be specifically directed by the Department of the Army. In peacetime, it is normally requisitioned by and issued to those units specifically designated by the Department of the Army. The basic load of ammunition is not necessarily loaded on transport at all times but may be stowed at gun positions or stored in dumps. The composition of the basic load of ammunition, including fuzes, by type will, in general, be as established by SB 38-26. However, this proportion of type may be varied by army commanders and unit commanders, based on assigned missions, and will be supplied so far as availability will permit. Bulk allotment items included in the basic load are listed in SB 38-26. The data for basic loads, as shown in the tables, provide the basis for instruction in all Department of the Army schools, to the exclusion of all other similar data. Under no circumstances will the average 50 percent overload of vehicles be used as a vehicle loading guide.

b. Required Supply Rate. The required supply rate is the amount of ammunition expressed in terms of rounds per weapon per day for ammunition items fired by weapons; and in terms of other units of measure per day for bulk allotment and other items, estimated to be required to sustain operations of any designated force without restriction for a specified period. Tactical commanders use this rate to state their requirement for ammunition to support planned

tactical operations at specified intervals. Required supply rates are submitted through command channels and are consolidated at each echelon and considered by the commander in determining the available supply rate within his command. The required supply rate is computed on and applied to tactical weapons only.

c. Available Supply Rate. The available supply rate is the rate of consumption of ammunition that can be sustained with available supplies, announced by each commander and applicable within his command. For ammunition items fired from weapons, this rate is expressed in rounds per weapon per day. For bulk allotment items such as antitank mines, hand grenades, and demolition explosives, the rate is expressed in terms of units of measure (ea, lb.) by organization, individual, or vehicle per day. It is flexible to conform to changing operational plans and commitments and changing tactical conditions. It is used as a control within a unit on the amount of ammunition that may be expended by that unit. At army group and army level, the term is also used as a forecast of ammunition availability. The available supply rate is computed on, and applied to, tactical weapons only; that is, the weapons in divisions, and the crew-served weapons in nondivisional tactical units. Weapons in combat support units and service support units are excluded unless unusual circumstances necessitate their employment in a combat role.

d. Supply to Units Within Combat Zone. The efficient operation of the ammunition supply system in the combat zone depends upon the maintenance of basic loads, by drawing ammunition from the depot or supply point designated to support the unit. Maintenance of the basic load is the responsibility of the unit commander. The supply installations supporting the unit will fill ammunition requisitions received bearing the statement: "Required to Replenish Basic Load (or Required for Immediate Consumption): Expenditures Are Within Authorized Available Supply Rate." When an ammunition supply point is unable to fill ammunition requisitions, the supply point commander reports that fact promptly to the army ammunition supply officer, requests instructions as to

where the ammunition can be obtained, and instructs the unit ammunition representative accordingly.

e. Ammunition Day of Supply. The ammunition day of supply is the estimated quantity of ammunition required per day to sustain operations in an active theater in wartime. It is expressed in terms of rounds per weapon per day for ammunition items fired by weapons, and in terms of other units of measure for bulk allotment and other ammunition items. It is used by the Department of the Army for overall supply planning and supply control purposes and by theater commanders in establishing theater stock levels. The basis is applied to weapons authorized to be in the hands of all troops in the theater, beginning with their arrival in the theater. The ammunition day of supply includes the proper proportions of types of rounds for each weapon and the correct proportions of types of fuzes and extra fuzes for the various types of rounds. The ammunition day of supply is contained in SB 38-26 and AR 11-8. It is for use, initially, in a newly established theater and is the basis for initial stockage of the theater, and for use until such time as experience provides a firm basis for correction. It is applicable to a balanced theater army command of not less than 150,000 men, and will require evaluation and may require adjustment should the army command be unbalanced or consist of a lesser number. It is used for detailed current planning and supply purposes in support of an active theater of operations. It is applicable to currently assigned troop strength and organization. It is established by the Department of the Army in conjunction with appropriate theater commanders. If an established theater becomes active, the provisions of SB 38-26 and AR 11-8 will govern until experience indicates that a revision for that theater is required. It is the responsibility of theater commanders, for both new and established theaters, to make continuous studies of ammunition expenditures and recommend to the Department of the Army necessary changes to established ammunition days of supply, in order that planning data will be maintained current. Consideration will be given to the fact that increases in the ammunition day of supply will result in increases in production rates, will require additional manpower and raw

materials, and may require additional manufacturing facilities. When an increase must be supported by new procurement, a minimum time lag of 12 months normally occurs between the theater recommendations to the Department of the Army and the arrival of the materials in the theater. Decreases in requirements for ammunition will be promptly reported to the Department of the Army in order that production programs may be adjusted as promptly as possible, with the release of manpower, facilities, and raw materials to other channels.

f. Army Commander. The army commander is responsible for—

- (1) Evaluation of the required supply rates submitted by the corps and other tactical organizations assigned or attached to the army and submission of a consolidated required supply rate to the army group commander.
- (2) Determination of available supply rates to corps and other tactical organizations assigned or attached to the army.
- (3) Submission of ammunition status reports.
- (4) Recommendation of basic load to suit his mission.
- (5) Maintenance of adequate tactical reserves in army ammunition installations and distribution of ammunition within the field army area.
- (6) Calling forward ammunition from the communications zone to replenish withdrawals from army ammunition installations.
- (7) Enforcement of supply economy.

g. Corps, Division, and Other Tactical Unit Commanders. Corps, division, and other tactical unit commanders are responsible for—

- (1) Evaluation of the required supply rates submitted by subordinate tactical commands and submission of a consolidated required supply rate to the next higher tactical commander.
- (2) Determination of the available supply rates, based on availability to subordinate tactical commanders.
- (3) Maintenance of basic loads at prescribed level.
- (4) Enforcement of supply economy.

h. Procedures. See FM 9-6 and FM 100-10.

5.25. Ordnance Ammunition Day of Supply Data—Weapons

Information regarding estimated average quantity of ammunition required per day to sustain operations in an active combat theater is contained in DA Supply Bulletin 38-26. Proportion of types of rounds, fuzes, and extra fuzes is included where applicable.

5.26. Ordnance Ammunition Day of Supply Data

Information regarding estimated average quantity of demolitions, explosives, grenades,

and pyrotechnics required per division per day to sustain operations in an active combat theater is contained in DA Supply Bulletin 38-26.

5.27. Chemical Ammunition Day of Supply Data

Information regarding estimated average quantity of chemical hand grenades, smoke pots, landmines, and incendiaries required per organization per day to sustain operations in an active combat theater is contained in DA Supply Bulletin 38-26.

5.28. Combat Vehicle Ammunition Data

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Armament				Miscellaneous stowage ¹			Rounds per vehicle				Ammunition						
Combat vehicles	Principal weapon	Cal .30 MG	Cal .50 MG	Grenades per vehicle	Flares, signal ground per vehicle	Miscellaneous per vehicle	Principal weapon	Cal .30 MG	Cal .45 SMG	Cal .50 MG	Ammunition stowage (in rounds per vehicle)				Rounds per vehicle in trains		
											Principal weapon	Cal .30 MG	Cal .45 SMG	Cal .50 MG	Principal weapon	Cal .30 MG	Cal .50 MG
2	Howitzer, SP, FT, 105-mm, M37 (TM 9-717).	How, 105-mm, M4.	---	1	8 hand	-----	276	-----	750	990	126	-----	750	990	150	-----	0
3	Howitzer, SP, FT, 105-mm, M52 (TM 9-7204).	105-mm how	---	1	8 grenades, smoke or frag.	-----	275	-----	-----	945	102	-----	200	945	173	-----	0
4	Howitzer, SP, FT, 155-mm, M41, M44, M44A1 (TM 9-744).	155-mm how, M1.	---	1	12 hand	-----	210	-----	420	-----	22	-----	420	900	188	-----	0
5	Howitzer, SP, FT, 155-mm, M44	155-mm how	---	1	8 grenades, smoke or frag.	-----	150	-----	-----	945	20	-----	200	945	130	-----	0
6	Howitzer, SP, FT, 8-inch, M43 (TM 9-747).	8-inch how, M1 or M2.	---	1	10 rifle, 12 hand.	-----	150	-----	-----	-----	{ HE-prop fuze prim 12 12 25 50 }	-----				900	136
7	Howitzer, SP, FT, 8-in., M55 (TM 9-7220).	8-inch how, T89.	---	1	8 hand	-----	150	-----	-----	-----		-----				945	120
8	Gun, SP, HT, M16, M16A1, M16A2 (TM 9-710).	4 cal .50 MG, M2.	---	---	10 rifle, 26 hand.	-----	-----	-----	420	7,100	-----	-----	420	5,000	-----	-----	2,100
9	Gun, SP, FT, twin, 40-mm, M19A1, M42 (TM 9-761).	Twin 40-mm gun, M2.	---	---	10 rifle, 12 hand.	-----	720	-----	480	-----	352	-----	480	-----	368	-----	-----
10	Gun, SP, FT, 155-mm, M53 (TM 9-7212).	155-mm gun	---	1	8 hand	-----	170	-----	180	945	20	-----	180	945	150	-----	0
11	Mortar, SP, HT, 81-mm, M21, M4 (TM 9-710).	81-mm mort, M1.	---	1	12 hand	-----	120	-----	600	715	97	-----	600	400	23	-----	315
12	Mortar, SP, FT, 4.2-inch, M84	4.2-in. mortar, M30.	---	1	12 hand	-----	136	-----	-----	1,800	96	3,000	-----	630	40	-----	1,170
13	Rocker, 762-mm, SP	762-mm rkt	---	---	-----	-----	5	-----	-----	-----	1	-----	-----	-----	4	-----	-----
14	Tank, 76-mm gun, M41 (TM 9-730)	76-mm, T91E3	1	1	8 hand	-----	62	5,475	-----	735	57	5,225	-----	630	5	250	105
15	Tank, 76-mm gun, M41A1 (TM 9-730)	76-mm, T91E3	1	1	8 hand	12	70	5,000	-----	735	65	5,000	180	630	5	-----	105
16	Tank, 90-mm gun, M48	90-mm, M41	1	1	8 hand	12	77	6,500	180	630	60	5,750	180	525	17	750	105
17	Tank, 120-mm gun, M103	120-mm, T123E1.	2	1	12 hand	-----	43	8,850	180	1,105	33	8,850	180	1,000	10	500	105
18	Vehicle, landing, tracked, (unarmored) LVT (4).	-----	2	2	24 hand	-----	-----	4,000	-----	5,000	-----	4,000	-----	5,000	-----	0	0

See footnotes at end of table.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	Armament				Miscellaneous stowage ¹			Rounds per vehicle				Ammunition						
1	Combat vehicles	Principal weapon	Cal .30 MG	Cal .50 MG	Grenades per vehicle	Flares, signal ground per vehicle	Miscellaneous per vehicle	Principal weapon	Cal .30 MG	Cal .45 SMG	Cal .50 MG	Ammunition stowage (in rounds per vehicle)				Rounds per vehicle in trains		
												Principal weapon	Cal .30 MG	Cal .45 SMG	Cal .50 MG	Principal weapon	Cal .30 MG	Cal .50 MG
19	Vehicle, armored infantry, M75 (T18E2).			1			Rkt, 3.5-in., 10 rnd.			180	1,800			180	1,800			0
20	Vehicle, armored, infantry, M59			1	20 hand	12				180	1,995			180	1,995			0
21	Vehicle, tank, recovery, M51			1	20 hand		Rkt, 3.5-in., 10 rnd, 6 pot, smoke.			180	1,815				1,500			315
22	Vehicle, tank, recovery, M74		1	1	20 hand	16	6 pot, smoke		2,000		1,680		2,000	180	1,050			630

¹ Included in basic load.

5.29. Estimated Expenditures of Ammunition

a. Ammunition Per Weapon Per Day, Expressed in Rounds.¹

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Weapon	Type of combat													
		Attack of position					Covering and security force action	Defense of position		Inactive situation	Meeting engage- ment	Pursuit	Retire- ment or delaying action	Assault of hostile shore	Pro- tracted period
		Permanent fortifications		Deliberately organized		Hastily organ- ized		First day	Succeed- ing days						
		First day	Succeed- ing days	First day	Succeed- ing days										
2	Carbine, cal .30-----	6	3	6	3	5	4	8	6	1.0	4	1.0	3.0	5	2.0
3	Gun, machine, cal .30, Bng-----	170	100	160	90	120	100	200	120	40.0	100	20.0	70.0	120	50.0
4	Gun, submarine, cal .45-----	35	20	35	20	25	20	40	25	8.0	20	4.0	15.0	25	10.0
5	Gun, machine, cal .50 (HB) ² -----	50	30	50	30	35	30	60	35	15.0	30	5.0	20.0	35	20.0
6	Gun, 155-mm, towed or SP-----	85	50	80	45	60	0	100	60	20.0	50	0.0	0.0	60	25.0
7	Howitzer, 105-mm, towed or SP-----	150	90	145	80	110	90	180	110	35.0	90	18.0	65.0	110	45.0
8	Howitzer, 155-mm, towed or SP-----	120	70	110	65	85	0	140	85	30.0	70	15.0	50.0	85	35.0
9	Howitzer, 8-in., towed or SP-----	85	50	80	45	60	0	100	60	20.0	50	0.0	0.0	60	25.0
10	Launcher, rocket, 3.5-in.-----	5	3	5	3	3	2	6	4	1.0	2	1.0	2.0	4	1.5
11	Mortar, 81-mm-----	70	40	64	35	50	40	80	50	16.0	40	8.0	30.0	50	20.0
12	Mortar, 4.2-in.-----	70	40	64	35	50	40	80	50	16.0	40	8.0	30.0	50	20.0
13	Pistol, auto, cal .45-----	2	1	2	1	1	1	2	1	0.2	1	0.2	0.3	2	0.3
14	Rifle, cal .30-----	20	15	20	15	15	15	25	15	5.0	15	3.0	10.0	15	6.0
15	Rifle, automatic, cal .30, Bng-----	70	40	65	35	50	40	80	50	15.0	40	8.0	30.0	50	20.0
16	Rifle, 57-mm (recoilless)-----	10	6	10	6	7	6	12	7	2.0	6	1.0	5.0	7	3.0
17	Rifle, 75-mm (recoilless)-----	7	4	7	4	5	4	8	5	2.0	4	1.0	3.0	5	2.0
18	Tank, combat, FT, 76-mm gun-----	15	8	13	7	10	8	16	10	3.0	8	2.0	5.0	10	4.0
19	Tank, combat, FT, medium, 90-mm gun.	22	12	20	11	15	12	25	15	5.0	12	3.0	8.0	15	6.0

¹Figures were derived from a study of World War II experience plus consideration of postwar development of materiel and reorganization of units. The quantities are representative of actual requirements when applicable to units of battle group size or larger.

²Multiple mounts will require specified quantities for each barrel.

b. Ammunition Per Type Unit Per Day, Expressed in Tons.¹

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Unit	Type of combat													
		Attack of position					Cover- ing and security force— action	Defense of position		Inactive situation	Meeting engage- ment	Pursuit	Retire- ment or delaying action	Assault of hostile shore	Airborne assault
		Permanent fortifications		Deliberately organized		Hastily organ- ized		First day	Succeed- ing days						
		First day	Succeed- ing days	First day	Succeed- ing days										
2	Divisional slice.....	850	500	800	450	600	400	1,000	600	200	500	100	350	600	-----
3	Airborne division.....	466	271	437	249	329	197	545	321	116	267	60	192	333	286
4	Armored division.....	512	297	480	271	361	222	597	366	125	292	66	208	366	-----
5	Infantry division.....	544	317	511	289	386	243	638	390	146	313	69	226	390	-----
6	Corps artillery—155-mm howitzer (per bn)---	121	71	111	66	86	80	142	86	30	71	15	51	86	-----
7	Corps artillery—155-mm gun (per bn)-----	69	40	65	36	48	0	81	48	16	40	0	0	48	-----
8	Corps artillery—8-in. howitzer (per bn)-----	116	68	110	62	82	0	137	82	27	68	0	0	82	-----

¹Figures were derived from World War II experience. These data may be used for planning purposes with modifications made for postwar reorganization of units.

5.30. Field Artillery Ammunition Expenditures¹

a. Expressed in Rounds Per Weapon Per Hour. (These figures are suitable for computing expenditures for periods of time less than 6 hours.)

	1	2	3	4
	Kind of fire or phase of action	Average rate per piece per hour		
		105-mm howitzer	155-mm howitzer	155-mm gun—8-in. how
1	Kind of fire or phase of action			
2	Advance guard action, development, and deployment.	25	12	-----
3	Preparation----- Supporting fires during the attack (including counterbattery):	80	25	25
4	First 2 hours-----	50	25	25
5	After 2 hours-----	30	15	15
6	Exploitation, pursuit, delaying action, or delaying enemy development.	25	12	12
7	Counterpreparation-----	60	25	25
8	Defensive fires against infantry attack (including counterbattery).	50	25	25
9	Fortified position-----	50	25	25

¹The figures in the following tables are derived from World War II experience. They will require modification to fit modern organizations and tactical concepts.

b. Expressed in Tons Per Battalion Per Hour. (These figures are suitable for computing expenditures for periods of time less than 6 hours.)

	1	2	3	4
	Kind of fire or phase of action	Average tonnage per battalion per hour		
		105-mm howitzer	155-mm howitzer	155-mm gun
1	Kind of fire or phase of action			
2	Advance guard action development, and deployment.	11.02	12.35	-----
3	Preparation----- Supporting fires during the attack (including counterbattery):	35.28	25.87	20.55
4	First 2 hours-----	22.05	25.87	20.55
5	After 2 hours-----	13.22	15.52	12.33
6	Exploitation, pursuit, delaying action, or delaying enemy development.	11.02	12.42	9.86
7	Counterpreparation-----	26.46	25.87	20.55
8	Defensive fires against infantry attack (including counterbattery).	22.05	25.87	20.55

5.31. Ammunition Supply Data—Airborne Division (ROTAD)

	1	2	3	4	5	6	7	8	9	10	11	12
	Unit and type munition	Rnd per wpn	Wt per rnd (lb)	Total wpn	Total rnd	Carried on individual		Carried on vehicle		Bulk loaded		Total wt (lb)
						Rnd per wpn	Total wt (lb)	Rnd per wpn	Total wt (lb)	Rnd per wpn	Total wt (lb)	
1	5 BG (ea) (TOE 7-31T)											
2	Pistol, auto, cal .45-----	28	.057	190	5,320	28	303.24					303.24
3	Rifle, US, cal .30-----	240	.095	844	202,560	96	7,697.28	144	11,545.92			19,243.20
4	Carbine, cal .30-----	90	.036	454	40,860	60	980.64	30	490.32			1,470.96
5	Rifle, auto, cal .30, Bng-----	740	.086	120	88,800	60	619.20	380	3,921.6	300	3,096.0	7,636.80
6	Gun, machine, cal. .30, 1919A6	3,000	.076	56	168,440	500	2,408.0	1,500	15,360.0	1,000	4,816.0	14,448.00
7	Launcher, rocket, 3.5-in-----	16	17.7	73	1,178	1	1,292.1	9	13,628.9	6	5,752.6	20,673.60
8	Mortar, 81-mm-----	120	15.(avg)	10	1,200			48	7,200.0	72	10,800.0	18,000.00
9	Recoilless rifle, 106-mm-----	50	60.0	10	500			30	18,000.0	20	12,000.0	30,000.00
10	Mortar, 4.2-in-----	180	32.0	8	1,440			60	15,360.0	120	30,720.0	46,080.00
11	Gun, 90-mm, SP, M56-----	89	64.5	6	534			29	11,223.0	60	23,220.0	34,443.00
12	Grenade, hand-----		2.1		3,000	1,500	3,150.00			1,500	3,150.0	6,300.00
13	Grenade, rifle-----	20	6.9	146	2,920	2	2,014.8	8	8,059.2	10	10,074.0	20,148.00
14	Mine, AT, M7A2-----		7.2		400	200	1,440.0			200	1,440.0	2,880.00
15	Mine, AT, M6A2-----		32.0		100					100	3,200.0	3,200.00
												224,916.18=112.46 ×5× tons
												1,124,580.90=562.29 tons
	DIV ARTY (TOE 6-200T)											
16	Pistol, auto, cal .45-----	21	.057	19	399	21	22.74					22.74
17	Rifle, US, cal .30-----	160	.095	31	4,960	48	145.16			112	326.04	471.20
18	Carbine, cal .30-----	90	.036	786	70,740	60	364.43			30	182.21	546.64
19	Gun, machine, cal .30, M1919A6.	3,000	.086	38	114,000	250	817.0	750	2,451.0	2,000	6,536.0	9,804.00
20	Launcher, rocket, 3.5-in-----	10	17.7	42	420	1	743.4	3	2,220.2	6	4,460.4	7,434.00
21	Howitzer, 105-mm-----	190	60.0	25	4,750			30	45,000.0	160	240,000.0	285,000.00
22	Rocket, 762-mm-----	2	6,060.0	4	8			2	48,480.0			48,480.00
23	Grenade, hand-----		2.1		750	750	1,575.0					1,575.00
24	Grenade, rifle-----	2	6.9	31	62	2	427.8					427.80
												353,761.38=176.88 tons

ENGR BN (TOE 5-225T)											
25	Pistol, auto, cal .45-----	28	.057	8	224	28	12.76	-----	-----	-----	12.76
26	Rifle, US, cal .30-----	96	.095	235	22,560	96	2,143.2	-----	-----	-----	2,143.20
27	Carbine, cal .30-----	90	.036	122	10,980	60	263.52	30	131.76	-----	395.28
28	Gun, submachine, cal .45-----	90	.057	64	5,760	90	328.32	-----	-----	-----	328.32
29	Rifle, auto, cal .30, Bng-----	120	.086	48	5,760	60	247.68	30	123.84	30	123.84
30	Gun, machine, cal .30, M1919A6, 2,000		.086	30	60,000	500	1,290.0	500	1,290.0	1,000	2,580.0
31	Launcher, rocket, 3.5-in-----	12	17.7	10	120	1	177.0	5	885.0	6	1,062.0
32	Grenade, hand-----		2.1		450	450	945.0	-----	-----	-----	945.00
33	Mine, AT, M7A2-----		7.2		160	-----	-----	-----	160	1,152.0	1,152.00
34	Mine, AT, M6A2-----		32.0		500	-----	-----	-----	500	16,000.0	16,000.00
35	Explosives-----										12,000.00
											40,755.92 = 20.38 tons
SIG BN (TOE 11-555T)											
36	Pistol, auto, cal .45-----	21	.057	4	84	21	4.79	-----	-----	-----	4.79
37	Rifle, US, cal .30-----	96	.095	238	22,848	96	2,170.56	-----	-----	-----	2,170.56
38	Carbine, cal .30-----	90	.036	127	11,430	60	274.32	30	137.16	-----	411.48
39	Gun, submachine, cal .45-----	90	.057	70	6,300	90	359.1	-----	-----	-----	359.10
40	Launcher, rocket, 3.5-in-----	4	17.7	10	40	1	177.0	-----	-----	3	531.0
41	Gun, machine, cal .30, M1919A6, 2,000		.086	15	30,000	500	645.0	500	645.0	1,000	1,290.0
42	Grenade, hand-----		2.1		400	300	630.0	-----	-----	100	210.0
43	Grenade, rifle-----	2	6.9	65	130	1	448.5	-----	-----	1	448.5
44	Gun, machine, cal .50, HB-----	530	.039	2	1,060	-----	-----	530	41.34	-----	41.34
											8,012.27 = 4.01 tons
COMD AND CON BN HQ & HQ CO (TOE 57-6T)											
45	Pistol, auto, cal .45-----	21	.057	37	777	21	44.28	-----	-----	-----	44.28
46	Carbine, cal .30-----	96	.036	191	18,336	96	660.10	-----	-----	-----	660.10
47	Launcher, rocket, 3.5-in-----	4	17.7	6	24	1	106.2	1	106.2	2	212.4
48	Grenade, hand-----		2.1		200	200	420.0	-----	-----	-----	420.00
											1,599.18 = .77 ton

	1	2	3	4	5	6	7	8	9	10	11	12
	Unit and type munition	Rnd per wpn	Wt per rnd (lb)	Total wpn	Total rnd	Carried on individual		Carried on vehicle		Bulk loaded		Total wt (lb)
						Rnd per wpn	Total wt (lb)	Rnd per wpn	Total wt (lb)	Rnd per wpn	Total wt (lb)	
1	ADMIN CO (TOE 12-157T)											
49	Pistol, auto, cal .45-----	21	.057	12	252	21	14.36					14.36
50	Rifle, US, cal .30-----	48	.095	30	1,440	48	136.80					136.80
51	Carbine, cal .30-----	30	.036	87	2,610	30	93.96					93.96
52	Gun, submachine, cal .45-----	90	.057	7	630	30	11.97			60	23.94	35.91
53	Gun, machine, cal .30, M1919A6.	500	.086	4	2,000			250	86.0	250	86.0	172.00
54	Gun, machine, cal .50-----	530	.039	1	530			530	20.67			20.67
55	Launcher, rocket, 3.5-in.-----	2	17.7	3	6	1	53.1			1	53.1	106.20
56	Grenade, rifle-----	1	6.9	10	10	1	69.0					69.00
57	Grenade, hand-----		2.1		50					50	105.0	105.00
												753.90 = .38 tons
	AVN CO (TOE 1-57T)											
58	Pistol, auto, cal .45-----	21	.057	51	1,071	21	61.05					61.05
59	Rifle, US, cal .30-----	96	.095	44	4,224	48	200.64	48	200.64			401.28
60	Carbine, cal .30-----	90	.036	55	4,950	60	118.8			30	59.4	178.20
61	Grenade, hand-----		2.1		100	100	210.0					210.00
												850.53 = .43 tons
	CAV TRP (TOE 57-57T)											
62	Pistol, auto, cal .45-----	21	.057	44	924	21	52.67					52.67
63	Rifle, US, cal .30-----	144	.095	61	8,784	96	556.32	48	278.16			834.48
64	Carbine, cal .30-----	90	.036	100	9,000	60	216.0	30	108.0			324.00
65	Rifle, auto, cal .30, Bng-----	740	.086	10	7,400	60	51.6	380	584.8			636.40
66	Mortar, 81-mm-----	70	15.(avg)	2	140			40	1,200.0	30	900.0	2,100.00
67	Recoilless rifle, 106-mm-----	50	60.0	4	200			30	7,200.0	20	4,800.0	12,000.00
68	Launcher, rocket, 3.5-in.-----	10	17.7	4	40	2	141.6	4	283.2	4	283.2	708.00
69	Gun, machine, cal .30, M1919A4.	3,000	.086	10	30,000	500	43.0	1,000	860.0	1,500	1,290.0	2,580.00
70	Grenade, rifle-----	20	6.9	6	120	2	82.8	8	331.2	10	414.0	828.00

71	Grenade, hand-----		2.1		200	200	420.0					420.00
	SPT GP HQ & HQ CO (TOE 29-56T)											20,483.55 = 10.24 tons
72	Pistol, auto, cal .45-----	21	.057	4	84	21	4.79					4.79
73	Rifle, US, cal .30-----	96	.095	46	4,416	96	419.52					419.52
74	Carbine, cal .30-----	90	.036	78	7,110	90	252.72					252.72
75	Rifle, auto, cal .30, Bng-----	120	.086	2	240	60	10.32	60	10.32			20.64
76	Gun, machine, cal .30, M1919A6.	1,000	.086	3	3,000	500	129.0	500	129.0			258.00
77	Launcher, rocket, 3.5-in.-----	4	17.7	2	8	1	35.4	1	35.4	2	70.8	141.60
78	Grenade, hand-----		2.1		100	100	210.0					210.00
	MAINT BN HQ AND MAINT SPT CO (TOE 29-66T)											1,307.27 = .65 tons
79	Pistol, auto, cal .45-----	21	.057	5	105	21	5.99					5.99
80	Rifle, US, cal .30-----	96	.095	96	9,216	48	437.76			48	437.76	875.52
81	Carbine, cal .30-----	90	.036	172	15,480	30	185.76			60	371.52	557.28
82	Gun, submachine, cal .45-----	90	.057	11	990	30	18.81			60	37.62	56.43
83	Gun, machine, cal .50-----	530	.039	2	1,060			530	41.34			41.34
84	Launcher, rocket, 3.5-in.-----	4	17.7	6	24	1	106.2	1	106.2	2	212.4	424.80
	EMERG REP CO (TOE 29-67T)											1,961.36 = .98 tons
85	Pistol, auto, cal .45-----	21	.057	6	126	21	7.18					7.18
86	Rifle, US, cal .30-----	96	.095	56	5,276	96	510.72					510.72
87	Carbine, cal .30-----	90	.036	98	8,820	90	317.52					317.52
88	Gun, submachine, cal .45-----	90	.057	12	1,080	60	41.04	30	20.52			61.56
89	Gun, machine, cal .30, M1919A6.	2,000	.086	39	78,000	500	1,677.0	1,000	3,354.0	500	1,677.0	6,708.00
90	Launcher, rocket, 3.5-in.-----	4	17.7	3	12	1	53.1	1	53.1	2	106.2	212.40
91	Grenade, hand-----		2.1		150	150	315.0					315.00
												8,132.38
												8,132.38 = 4.07 tons

	1	2	3	4	5	6	7	8	9	10	11	12
	Unit and type munition	Rnd per wpn	Wt per rnd (lb)	Total wpn	Total rnd	Carried on individual		Carried on vehicle		Bulk loaded		Total wt (lb)
						Rnd per wpn	Total wt (lb)	Rnd per wpn	Total wt (lb)	Rnd per wpn	Total wt (lb)	
	MED CO (TOE 8-67T)											
92	Pistol, auto, cal .45-----	21	.057	15	315	21	17.96					17.96
93	Rifle, US, cal .30-----	96	.095	22	2,112	48	100.32	48	100.32			200.64
94	Carbine, cal .30-----	90	.036	201	18,090	60	434.16	30	217.08			651.24
												869.84 = .44 tons
	SUP AND TRANS CO (TOE 29-57T)											
95	Pistol, auto, cal .45-----	21	.057	2	42	21	2.46					2.46
96	Rifle, US, cal .30-----	96	.095	69	6,624	96	629.28					629.28
97	Carbine, cal .30-----	90	.036	94	8,460	60	203.04	30	101.52			304.56
98	Gun, submachine, cal .45-----	90	.057	6	540	60	20.52	30	10.26			30.78
99	Launcher, rocket, 3.5-in.-----	4	17.7	8	32	1	141.6	1	141.6	2	283.2	566.40
100	Grenade, hand-----		2.1		100	100	210.0					210.00
												1,743.48 = .87 tons
	QM PRCHT SUP CO (TOE 10-337T)											
101	Pistol, auto, cal .45-----	21	.057	1	21	21	1.20					1.20
102	Rifle, US, cal .30-----	96	.095	67	6,432	96	611.04					611.04
103	Carbine, cal .30-----	90	.036	113	10,170	30	122.04			60	244.08	366.12
104	Gun, submachine, cal .45-----	90	.057	3	270	60	7.69			60	7.69	15.39
105	Launcher, rocket, 3.5-in.-----	4	17.7	1	4	1	17.7			3	53.1	70.80
106	Grenade, hand-----		2.1		50	50	150.0					105.00
												1,169.55 = .58 tons
	Total tons for division-----											782.97 tons

5.32. Ammunition Supply Data — Armored Division (ROCAD)—Basic Load

a. Basic Load. The data contained in the tables in *b* below indicate that portion of the basic load of ammunition for the weapons authorized the unit by the appropriate TOE. Additional ammunition required to complete the unit's basic load is dependent upon the type of combat vehicles and the number of each authorized. This additional ammunition may be readily computed by utilizing the information for combat vehicles contained in paragraph 5.28.

- (1) To compute the basic load of ammunition of a unit—
 - (a) Determine the type of combat vehicles and the number of each in the unit.
 - (b) For each type of combat vehicle in the unit, multiply the number of rounds of each type ammunition per vehicle (cols 5–11, par. 5.28) by the number of vehicles in the unit.

This determines the ammunition required for the vehicular weapons.

- (c) Next add the amounts of ammunition determined above to the amounts indicated in the appropriate portion of the table for TOE weapons contained in *b* below. The sum of these figures will give the basic load of ammunition for the unit. Weight of the basic load of ammunition can be determined by using DA Supply Bulletin 38–26, which gives weight per round.
- (2) The basic load of armor units listed in paragraph 5.31, 5.33, or 5.34 may be computed in the same manner as outlined in (1) above.
- (3) In *c* and *d* below a list is given of the weights of the basic load of ammunition for each type armor unit utilizing specific vehicles as indicated and may be used for planning purposes and supply problems.

b. Ammunition Supply Data—Armored Division (ROCAD).

	1 Weapon (unit)	2 Rnd per wpn	3 No. of wpns	4 Total basic load		5 How carried (rnds per wpn)		
				Rounds	Tons	Indiv	Veh	Trains
	HQ & HQ CO, ARMD DIV, TOE 17–2T							
1	Carbine, cal .30 ^{1 5}	120	88	10,560	.19	60	60	
2	Gun, machine, cal .30, Bng, M1919A6	2,000	3	6,000	.27		2,000	
3	Gun, machine, cal .50, Bng, M2, HB ²	525	2	1,050	.20		525	
4	Gun, submachine, cal .45 ^{3 5}	120	26	3,120	.09	60	60	
5	Launcher, grenade, rifle ⁴	10	4	40	.06		10	
6	Launcher, rocket, 3.5-in.	10	3	30	.26		10	
7	Pistol, auto, cal .45	21	30	630	.01	21		
8	Rifle, US, cal .30	96	31	2,976	.11	48	48	
9	Total				1.19			
	AVN CO, TOE 1–17T							
10	Carbine, cal .30 ^{1 5}	120	79	9,480	.18	60	60	
11	Gun, machine, cal .30, Bng, M1919A4	2,000	4	8,000	.36		2,000	
12	Gun, machine, cal .50, Bng, M2, HB ²	525	2	1,050	.20		525	
13	Launcher, rocket, 3.5-in.	10	4	40	.35		10	
14	Pistol, auto, cal .45	21	76	1,596	.04	21		
15	Rifle, US, cal .30	96	85	8,160	.32	48	48	
16	Total				1.45			

See footnotes at end of table.

	1	2	3	4		5		
	Weapon (unit)	Rnd per wpn	No. of wpns	Total basic load		How carried (rnds per wpn)		
				Rounds	Tons	Indiv	Veh	Trains
	SIG BN, TOE 11-55T							
17	Carbine, cal .30 ^{1 5} -----	120	218	26,160	.48	60	60	-----
18	Gun, machine, cal.30, Bng, M1919A4	2,000	3	6,000	.27	-----	2,000	-----
19	Gun, machine, cal .50, Bng, M2, HB ² .	525	12	6,300	1.21	-----	525	-----
20	Gun, submachine, cal .45 ^{3 5} -----	120	93	11,160	.32	60	60	-----
21	Launcher, grenade, rifle ⁴ -----	10	3	30	.04	-----	10	-----
22	Launcher, rocket, 3.5-in.-----	10	14	140	1.23	-----	10	-----
23	Pistol, auto, cal .45-----	21	9	189	Negl	21	-----	-----
24	Rifle, auto, cal .30, Bng, M1918A2	1,000	3	3,000	.11	60	940	-----
25	Rifle, US, cal .30-----	96	179	17,184	.68	48	48	-----
26	Total-----	-----	-----	-----	4.34	-----	-----	-----
	MP CO, TOE 19-29T							
27	Carbine, cal .30 ^{1 5} -----	120	27	3,240	.05	60	60	-----
28	Gun, machine, cal.30, Bng, M1919A4	2,000	4	8,000	.36	-----	2,000	-----
	Gun, machine, cal .50, Bng, M2, HB ² .	525	1	525	.10	-----	525	-----
30	Gun, submachine, cal .45 ^{3 5} -----	120	48	5,760	.16	60	60	-----
31	Launcher, grenade, rifle ⁴ -----	10	12	120	.18	-----	10	-----
32	Launcher, rocket, 3.5-in.-----	10	4	40	.35	-----	10	-----
33	Pistol, auto, cal .45-----	21	64	1,344	.03	21	-----	-----
34	Rifle, US, cal .30-----	96	63	6,048	.24	48	48	-----
35	Total-----	-----	-----	-----	1.47	-----	-----	-----
	HQ & HQ CO, CC, TOE 17-22T							
36	Carbine, cal .30 ^{1 5} -----	120	69	8,280	.15	60	60	-----
37	Gun, machine, cal.30, Bng, M1919A6	2,000	5	10,000	.45	-----	2,000	-----
38	Gun, machine, cal .50, Bng, M2, HB ²	525	3	1,575	.30	-----	525	-----
39	Gun, submachine, cal .45 ^{3 5} -----	120	4	480	.01	60	60	-----
40	Launcher, rocket, 3.5-in.-----	10	4	40	.35	-----	10	-----
41	Pistol, cal .45-----	21	29	609	.01	21	-----	-----
42	Rifle, cal .30-----	96	26	2,496	.09	48	48	-----
43	Total-----	-----	-----	-----	1.36	-----	-----	-----
	ARMOR BN, 90-mm, TOE 17-25T							
44	Carbine, cal .30 ^{1 5} -----	120	66	7,920	.14	60	30	30
45	Demolition set No. 5-----	220-lb	1	-----	.11	-----	20-lb	200-lb
46	Gun, machine, cal.30, Bng, M1919A4	3,250	12	39,000	1.70	-----	1,000	2,250
47	Gun, machine, cal .30, M1919A6, Bng.	3,250	4	13,000	.58	-----	1,000	2,250
48	Gun, machine, cal .50 Bng, M2, HB ²	525	23	12,075	2.33	-----	315	210
49	Gun, submachine, cal .45 ^{3 5} -----	120	257	30,840	.89	30	60	30
50	Launcher, grenade, rifle ⁴ -----	10	6	60	.09	-----	5	5
51	Launcher, rocket, 3.5-in.-----	9	37	333	2.94	-----	6	3
52	Pistol, cal .45-----	21	386	8,106	.23	21	-----	-----
53	Rifle, US, cal .30-----	120	163	19,560	.78	48	48	24
54	Mine, AT (hv), M15-----	-----	-----	200	4.00	-----	-----	200

See footnotes at end of table.

	1	2	3	4		5		
	Weapon (unit)	Rnd per wpn	No. of wpns	Total basic load		How carried (rnds per wpn)		
				Rounds	Tons	Indiv	Veh	Trains
	ARMOR BN, 90-mm, TOE 17-25--TContinued							
55	Mine, AP, M14			450	.11			450
56	Mine, AP, M16			52	.24			52
57	Total				14.13			
	ARMD INF BN, TOE 7-25T							
58	Carbine, cal .30 ^{1 5}	120	81	9,720	.17	60	30	30
59	Gun, machine, cal .50, Bng, M2, HB ²	525	22	11,550	2.22		315	210
60	Gun, submachine, cal .45 ^{3 5}	160	109	17,440	.50	40	60	60
61	Launcher, rocket, 3.5-in.	12	70	840	7.41		6	6
62	Pistol, cal .45	21	167	3,507	.10	21		
63	Rifle, auto, cal .30, Bng, M1918A2	1,000	72	72,000	2.77	60	480	460
64	Rifle, US, cal .30	120	589	70,680	2.82	48	48	24
65	Rifle, US, cal .30, snipers	96	36	3,456	.13	48	48	
66	Demolition set No. 5	100-lb	5		.25		20-lb	80-lb
67	Gun, machine, cal .30, Bng, M1919A4	3,000	16	48,000	2.16		1,500	1,500
68	Gun, machine, cal .30, Bng, M1919A6	3,000	72	216,000	9.72		1,500	1,500
69	Launcher, grenade, rifle ⁴	10	183	1,830	2.76		5	5
70	Mortar, 81-mm	99	12	1,188	9.31		60	39
71	Mine, AT (hv), M15			680	13.94		480	200
72	Mine, AP, M14			450	.11			450
73	Mine, AP, M16			52	.24			52
74	Total				54.61			
	CAV SQ, TOE 17-45T							
75	Carbine, cal .30 ^{1 5}	120	121	14,520	.26	60	30	30
76	Demolition set No. 5	50-lb	16		.40		20-lb	30-lb
77	Gun, machine, cal .30, Bng, M1919A4	3,000	66	198,000	8.91		1,500	1,500
78	Gun, machine, cal .30, Bng, M1919A6	2,000	1	2,000	.09		2,000	
79	Gun, machine, cal .50, Bng, M2, HB ²	630	25	15,750	3.03		525	105
80	Gun, submachine, cal .45 ^{3 5}	120	219	26,280	.76	60	60	
81	Launcher, grenade, rifle ⁴	6	48	288	.43		5	1
82	Launcher, rocket, 3.5-in.	14	10	140	1.23		12	2
83	Pistol, cal .45	21	345	7,245	.21	21		
84	Rifle, auto, cal .30, Bng, M1919A2	1,000	24	24,000	.92	60	480	460
85	Rifle, US, cal .30	120	402	48,240	1.92	48	48	24
86	Mine, AT, HE (hv), M15			346	6.92		96	250
87	Mine, AP, M14			450	.11			450
88	Mine, AP, M16			52	.24			52
89	Total				25.43			
	ENGR BN, TOE 5-215T							
90	Carbine, cal .30 ^{1 5}	120	67	8,040	.15	60	30	30
91	Gun, machine, cal .30, Bng, M1919A4	3,000	40	120,000	5.40		1,500	1,500
92	Gun, machine, cal .50, Bng, M2, HB ²	525	47	24,675	4.76		315	210
93	Gun, submachine, cal .45 ^{3 5}	120	83	9,960	.29	60	60	
94	Launcher, rocket, 3.5-in.	10	47	470	4.13		5	5
95	Pistol, auto, cal .45	21	58	1,218	.04	21		

See footnotes at end of table.

	1	2	3	4		5		
	Weapon (unit)	Rnd per wpn	No. of wpns	Total basic load		How carried (rnds per wpn)		
				Rounds	Tons	Indiv	Veh	Trains
	ENGR BN, TOE 5-215T—Continued							
96	Rifle, US, cal .30-----	120	813	97,560	3.90	48	48	24
97	Explosives (including demolition sets).	16,040-lb			8.02		12,000-lb	4,040-lb
98	Demolition set No. 1-----		48					
99	Demolition set No. 2-----		12					
100	Demolition set No. 5-----		36					
101	Mines, AT, M15 (ea)-----			2,200	50.00 (crated)		1,600	600
102	Mines, AP, M16 (ea)-----			680	2.72 (crated)		480	200
103	Mines, AP, M14 (ea)-----			4,230	1.00 (crated)		3,240	990
104	Total-----				80.41			
	HQ & HQ BTRY, DIV ARTY, TOE 6-301T							
105	Carbine, cal .30 ^{1 5} -----	120	96	11,552	.21	60	60	
106	Gun, machine, cal .30, Bng, M1919A-----	2,000	1	2,000	.09		1,000	1,000
107	Gun, machine, cal .50, Bng, M2, HB ² -----	525	6	3,150	.60		525	
108	Launcher, rocket, 3.5-in.-----	10	6	60	.53		10	
109	Pistol, auto, cal .45-----	21	11	231	Negl	21		
110	Rifle, auto, cal .30, Bng, 1918A2-----	1,000	4	4,000	.15	60	480	460
111	Rifle, US, cal .30-----	96	67	6,432	.26	48	48	
112	Total-----				1.84			
	FA HOW BN, 105-mm, SP, TOE 6-315T							
113	Carbine, cal .30 ^{1 5} -----	120	280	33,600	.62	60	60	
114	Gun, machine, cal .30, Bng, M1919A4-----	2,000	19	38,000	1.71		1,000	1,000
115	Gun, machine, cal .50, Bng, M2, HB ² -----	525	22	11,550	2.23		525	
116	Gun, submachine, cal .45 ^{3 5} -----	120	2	240	Negl	60	60	
117	Launcher, rocket, 3.5-in.-----	10	21	210	1.85		10	
118	Pistol, auto, cal .45-----	21	14	294	Negl	21		
119	Rifle, auto, cal .30, Bng, M1918A2-----	1,000	32	32,000	1.23	60	480	460
120	Rifle, US, cal .30-----	120	260	31,200	1.25	48	48	24
121	Total-----				8.89			
	FA COMP BN, TOE 6-325T							
122	Carbine, cal .30 ^{1 5} -----	120	263	31,560	.58	60	60	
123	Gun, machine, cal .30, Bng, M1919A4-----	2,000	26	52,000	2.34		1,000	1,000
124	Gun, machine, cal .50, Bng, M2, HB ² -----	525	8	4,200	.81		525	
125	Gun, submachine, cal .45 ^{3 5} -----	120	2	240	Negl	60	60	
126	Launcher, rocket, 3.5-in.-----	10	29	290	2.56		10	
127	Pistol, auto, cal .45-----	21	14	294	Negl	21		
128	Rifle, auto, cal .30, Bng, M1918A2-----	1,000	33	33,000	1.27	60	480	460
129	Rifle, US, cal .30-----	120	310	37,200	1.49	48	48	24
130	Total-----				9.05			

See footnotes at end of table.

	1	2	3	4		5		
	Weapon (unit)	Rnd per wpn	No. of wpns	Total basic load		How carried (rnds per wpn)		
				Rounds	Tons	Indiv	Veh	Trains
	HQ & HQ DET & BAND, ARMD DIV TN, TOE 17-62T							
131	Carbine, cal .30 ^{1 5} -----	120	54	6,480	.11	60	60	-----
132	Gun, submachine, cal .45 ^{3 5} -----	120	4	480	.01	60	60	-----
133	Pistol, auto, cal .45-----	21	3	63	Negl	21	-----	-----
134	Rifle, US, cal .30-----	96	7	672	.03	48	48	-----
135	Total-----	-----	-----	-----	.15	-----	-----	-----
	QM BN, TOE 10-45T							
136	Carbine, cal .30 ^{1 5} -----	120	282	33,840	.62	60	60	-----
137	Gun, machine, cal .30, Bng, 1919A4-----	2,000	2	4,000	.18	-----	2,000	-----
138	Gun, machine, cal .50, Bng, M2, HB ² -----	525	28	14,700	2.83	-----	525	-----
139	Gun, submachine, cal .45 ^{3 5} -----	120	16	1,920	.05	60	60	-----
140	Launcher, grenade, rifle ⁴ -----	10	24	240	.36	-----	10	-----
141	Launcher, rocket, 3.5-in.-----	10	6	60	.52	-----	10	-----
142	Pistol, auto, cal .45-----	21	5	105	Negl	21	-----	-----
143	Rifle, auto, cal .30, Bng, M1919A2-----	1,000	5	5,000	.19	60	940	-----
144	Rifle, US, cal .30-----	96	121	11,616	.46	48	48	-----
145	Total-----	-----	-----	-----	5.21	-----	-----	-----
	ORD BN, TOE 9-65T							
146	Carbine, cal .30 ^{1 5} -----	120	361	43,320	.80	60	60	-----
147	Gun, machine, cal .50, Bng, M2, HB ² -----	525	18	9,450	1.82	-----	525	-----
148	Gun, submachine, cal .45 ^{3 5} -----	120	34	4,080	.11	60	60	-----
149	Launcher, grenade, rifle ⁴ -----	10	9	90	.13	-----	10	-----
150	Launcher, rocket, 3.5-in.-----	10	12	120	1.05	-----	10	-----
151	Pistol, auto, cal .45-----	21	16	336	Negl	21	-----	-----
152	Rifle, US, cal .30-----	96	203	19,488	.77	48	48	-----
153	Total-----	-----	-----	-----	4.68	-----	-----	-----
	MED BN, TOE 8-75T							
154	Carbine, cal .30 ^{1 5} -----	120	305	36,600	.67	60	60	-----
155	Pistol, auto, cal .45-----	21	25	525	.01	21	-----	-----
156	Rifle, US, cal .30-----	96	33	3,168	.12	48	48	-----
157	Total-----	-----	-----	-----	.80	-----	-----	-----
	ADMIN CO, TOE 12-27T							
158	Carbine, cal .30 ^{1 5} -----	120	124	14,880	.27	60	60	-----
159	Gun, machine, cal .30, Bng, M1919A6-----	2,000	6	12,000	.54	-----	2,000	-----
160	Gun, machine, cal .50, Bng, M2, HB ² -----	525	1	525	.10	-----	525	-----
161	Gun, submachine, cal .45 ^{3 5} -----	120	4	480	.01	60	60	-----
162	Launcher, grenade, rifle ⁴ -----	10	9	90	.13	-----	10	-----
163	Launcher, rocket, 3.5-in.-----	10	4	40	.35	-----	10	-----
164	Pistol, auto, cal .45-----	21	16	336	Negl	21	-----	-----
165	Rifle, US, cal .30-----	96	36	3,456	.13	48	48	-----
166	Total-----	-----	-----	-----	1.53	-----	-----	-----

See footnotes on page 274.

¹ Latest publications authorize 30-round magazines entirely; it is desired to have ammunition on the individual, in the vehicle, and in the trains available in increments of 30 rounds without decreasing the amount available in any one location.

² All figures are expressed in terms of complete belts of ammunition packed 105 rounds per belt.

³ Reference note 1. The gun, submachine, cal .45 is also authorized 30-round magazines.

⁴ "Rounds per weapon" includes both the cartridge and the grenade.

⁵ Where vehicular stowage provides space for a greater number of rounds for gun, submachine, cal .45 and carbine, cal .30, than indicated in this table, the full stowage capacity will be used in computing the basic load of the unit.

c. Weight of Armored Division (ROCAD) Basic Load of Ammunition (based on type combat vehicles).

Unit	Wt of basic load for TOE weapons, mines, and demolitions (tons)	Wt of basic load for on-vehicle armament (tons)	Total wt of unit basic load (tons)	Total wt for div (tons)
Hq & Hq co, armd div, TOE 17-2T	1.19	3.89	5.08	5.08
Avn co, TOE 1-17T	1.45	0.00	1.45	1.45
Sig bn, TOE 11-55T	4.34	1.15	5.49	5.49
MP co, TOE 19-29T	1.47	0.00	1.47	1.47
Hq & Hq co, CC (3), TOE 17-22T	1.36	8.14	9.50	28.50
Armor bn, 90-mm (4), TOE 17-25T	14.13	230.70	244.83	979.32
Armd inf bn (4), TOE 7-25T	54.61	44.30	98.91	395.64
Cav sq, TOE 17-45T	25.43	120.18	145.61	145.61
Engr bn, TOE 5-215T	80.41	52.39	132.80	132.80
Hq & Hq btry, div arty, TOE 6-301T	1.84	1.16	3.00	3.00
FA how bn, 105-mm, SP (3), TOE 6-315T	8.89	157.63	166.52	499.56
FA comp bn, TOE 6-325T	9.05	206.37	215.42	215.42
Hq & Hq det & band, armd div tn, TOE 17-62T	.15	0.00	.15	.15
QM bn, TOE 10-45T	5.21	0.00	5.21	5.21
Ord bn, TOE 9-65T	4.68	5.11	9.79	9.79
Med bn, TOE 8-75T	.80	0.00	.80	.80
Admin co, TOE 12-27T	1.53	0.00	1.53	1.53
Total armored division				2,431.82

d. Weight of Basic Load of Ammunition for Armored Units Other Than Armored Division Units (based on type vehicles).

Unit	Wt of basic load for TOE wpns (tons)	Wt of basic load for SNL wpns (tons)	Total wt for unit basic load (tons)
Hq & Hq co, armd cav regt, TOE 17-52R	1.920	4.584	6.504
Svc co, armd cav regt, TOE 17-53R	7.164	2.745	9.909
Three recon bn, armd cav regt, TOE 17-55R	57.318	407.256	464.574
Total armd cav regt	66.402	414.585	480.987
Hq & Hq co, armor gp, TOE 17-32R	1.013		1.013
Tk bn, 120-mm gun nondiv, TOE 17-35C	19.430	212.866	232.296
Amph tk bn, TOE 17-115R	3.046	142.416	145.462
Amph trac bn, TOE 17-125R	1.712	124.752	126.464
Cav sq, inf div (ROCID), TOE 17-85T			72.65
Armor bn, 90-mm, inf div (ROCID), TOE 17-65T			278.46

5.33. Ammunition Supply Data—Infantry Division (ROCID)—Basic Load

	1	2	3	4	5	6	7	8	9	10	11	12
1	Unit and type munition	Rnd per wpn	Wt per rnd (lb)	Total wpn	Total rnd	Carried on individual		Carried on vehicle		Bulk loaded		Total wt (lb)
						Rnd per wpn	Total wt (lb)	Rnd per wpn	Total wt (lb)	Rnd per wpn	Total wt (lb)	
	5 BG (ea) (TOE 7-11T)											
2	Pistol, auto, cal .45-----	31	.057	194	6,014	21	232.22	7	77.41	3	33.17	342.80
3	Rifle, US, cal .30-----	200	.095	918	183,600	72	6,279.12	96	8,372.16	32	2,790.72	17,442.00
4	Rifle, US, cal .30, snipers-----	200	.095	48	9,600	72	328.32	96	437.76	32	145.92	912.00
5	Gun, machine, cal .50, on pers carr.	600	.39	2	1,200	-----	-----	400	312.00	200	156.00	468.00
6	Carbine, cal .30-----	90	.036	155	13,950	60	334.80	15	83.70	15	83.70	502.20
7	Gun, submachine, cal .45-----	560	.057	4	2,240	60	13.68	500	114.00	-----	-----	127.68
8	Rifle, auto, cal .30, Bng-----	740	.086	110	81,400	260	2,459.60	280	2,648.80	200	1,892.00	7,000.40
9	Gun, machine, cal .30, M1919A4.	3,250	.086	11	35,750	-----	-----	2,250	2,128.50	1,000	946.00	3,074.50
10	Gun, machine, cal .30, M1919A6.	3,250	.086	34	110,500	-----	-----	2,250	6,579.00	1,000	2,924.00	9,503.00
11	Gun, machine, cal .50-----	600	.39	6	3,600	-----	-----	400	936.00	200	468.00	1,404.00
12	Launcher, rocket, 3.5-in.-----	18	17.7	64	1,152	-----	-----	12	13,593.60	6	6,796.80	20,390.40
13	Mortar, 81-mm, on mount-----	120	15	13	1,560	-----	-----	48	9,360.00	72	14,040.00	23,400.00
14	Rifle, recoilless, 106-mm, on mount.	40	60	8	320	-----	-----	24	11,520.00	16	7,680.00	19,200.00
15	Mortar, 4.2-in., on mount-----	225	35	8	1,800	-----	-----	82	22,960.00	143	40,040.00	63,000.00
16	Gun, 90-mm, SP, M56-----	135	64.5	4	540	-----	-----	75	19,350.00	60	15,480.00	34,830.00
17	Grenade, hand-----	-----	2.1	-----	3,000	-----	-----	2,000	4,200.00	1,000	2,100.00	6,300.00
18	Launcher, grenade, rifle-----	20	6.9	178	3,560	2	2,456.40	8	9,825.60	10	12,282.00	24,564.00
19	Mine, AT, M7A2-----	-----	7.2	-----	400	-----	-----	200	1,440.00	200	1,440.00	2,880.00
20	Mine, AT, M15-----	-----	30.0	-----	100	-----	-----	-----	-----	-----	-----	3,000.00
21	Tank, 76-mm gun-----	62	32.0	2	124	-----	-----	57	3,648.00	5	320.00	3,968.00
22	Gun, machine, cal .50, on tank-----	735	.39	2	1,470	-----	-----	630	491.40	105	81.90	573.30
23	Grenade, hand, per tank-----	8	2.1	16	16	-----	-----	16	33.60	-----	-----	33.60
24	Gun, machine, cal .50, spotting-----	200	.39	8	1,600	-----	-----	120	374.40	80	240.60	615.00
												243,530.88 = 121.77 tons
												× 5 BG
												1,217,654.40 = 608.83 tons

	1	2	3	4	5	6	7	8	9	10	11	12
1	Unit and type munition	Rnd per wpm	Wt per rnd (lb)	Total wpm	Total rnd	Carried on individual		Carried on vehicle		Bulk loaded		Total wt (lb)
						Rnd per wpm	Total wt (lb)	Rnd per wpm	Total wt (lb)	Rnd per wpm	Total wt (lb)	
	<i>Armor Bn, 90-mm (TOE 17-65T)</i>											
25	Pistol, auto, cal .45-----	21	.057	457	9,597	21	547.03					547.03
26	Rifle, US, cal .30-----	120	.095	150	18,000	48	684.00	48	684.00	24	342.00	1,710.00
27	Carbine, cal .30-----	120	.036	78	9,360	60	168.48	30	84.24	30	84.24	336.96
28	Gun, submachine, cal .45-----	120	.058	270	32,400	30	469.8	60	939.6	30	469.8	1,879.20
29	Gun, machine, cal .30, M1919A4.	3,250	.086	13	42,250			1,000	1,118.00	2,250	2,515.50	3,633.50
30	Gun, machine, cal .50-----	525	.39	16	8,400			315	1,965.64	210	1,310.40	3,276.00
31	Launcher, rocket, 3.5-in.-----	9	17.7	37	333			6	3,929.40	3	1,964.70	5,894.10
32	Grenade, hand, in vehicles ¹ -----	(1)	2.1	(1)	1,128			(1)	2,368.8			2,368.8
33	Grenade, hand-----		2.1		150			150	315.00			315.00
34	Gun, machine, cal .50, on tank-----	630	.39	89	56,070			525	18,222.75	105	3,644.55	21,867.30
35	Tank, 90-mm gun-----	77	64.5	89	6,853			60	344,430.00	17	97,588.50	442,018.50
36	Gun, machine, cal .30, on tank-----	6,500	.086	89	578,500			5,750	44,010.50	750	5,740.50	49,751.00
37	Gun, machine, cal .50, on pers carr.	1,995	.39	18	35,910			1,995	14,004.9			14,004.90
38	Launcher, grenade, rifle-----	10	6.9	6	60			5	207	5	207	414
39	Demolition equipment, set No. 5.		220	1	1				20		200	220
40	Mine, AT (heavy), M15-----		40	(200)	200					200	8,000	8,000
41	Mine, AP, M14-----		.489	(450)	450					450	220	220
42	Mine, AP, M16-----		9.23	(52)	52					52	480	480
43	Flares, signal, ground ² -----	(2)	Negl	(2)	1,396			(2)	Negl			Negl
												556,936.29 = 278.46 tons
	<i>Div Arty (TOE 6-100T)</i>											
44	Pistol, auto, cal .45-----	21	.057	36	756	21	43.10					43.10
45	Rifle, US, cal .30-----	72	.095	941	67,752	48	4,290.96	24	2,145.48			6,436.44
46	Carbine, cal .30-----	90	.036	702	63,180	60	1,516.32	30	758.16			2,274.45
47	Rifle, auto, cal .30, Bng-----	500	.086	83	41,500	180	1,284.84	320	2,284.16			3,569.00
48	Gun, machine, cal .30, M1919A4.	2,000	.086	63	126,000	250	1,354.50	750	4,063.50	1,000	5,418.00	10,836.00
49	Gun, machine, cal .50-----	530	.39	38	20,140			530	7,854.60			7,854.60
50	Launcher, rocket, 3.5-in.-----	6	17.7	100	600			6	10,620.00			10,620.00
51	Howitzer, 105-mm-----	200	60.0	30	6,000			60	108,000.00	140	252,000.00	360,000.00
52	Howitzer, 155-mm-----	150	112.0	12	1,800			24	32,256.00	126	169,344.00	201,600.00
53	Howitzer, 8-in.-----	100	253.0	4	400			20	20,240.00	80	80,960.00	101,200.00
54	Launcher, rkt, 762-mm-----	5	6,060.0	2	10			1	12,120.00	4	48,480.00	60,600.00

55	Grenade, hand.....		2.1		750	50	105.00	700	1,470.00			1,575.00
56	Gun, submachine, cal .45.....	560	.057	1	560	60	3.42	500	28.50			31.92
<i>Engr Bn (TOE 5-15T)</i>												
57	Pistol, auto, cal .45.....	28	.057	19	532	21	22.74			7	7.58	30.32
58	Rifle, US, cal .30.....	96	.095	690	66,240	48	3,146.40			48	3,146.40	6,292.80
59	Carbine, cal .30.....	90	.036	56	5,040	60	120.96			30	60.48	181.44
60	Gun, submachine, cal .45.....	90	.057	25	2,250	60	85.50			30	42.75	128.25
61	Gun, machine, cal .30, M1919A4.....	2,750	.086	30	84,000			2,000	5,160.00	750	1,935.00	7,095.00
62	Gun, machine, cal .30, M1919A6.....	2,750	.086	2	5,500			2,000	344.00	750	129.00	473.00
63	Gun, machine, cal .50.....	730	.39	25	18,250			595	5,801.25	135	1,316.25	7,117.50
64	Launcher, grenade, rifle.....	20	6.9	130	2,600			10	8,970.00	10	8,970.00	17,940.00
65	Launcher, rocket, 3.5-in.....	12	17.7	39	468			6	4,141.80	6	4,141.80	8,283.60
66	Grenade, hand.....		2.1		1,125			675	1,417.50	450	945.00	2,362.50
67	Mine, AT, M7A2.....		7.2		160					160	1,152.00	1,152.00
68	Mine, AT, M15.....		30.0		500					500	15,000.00	15,000.00
69	Explosives.....											12,000.00
70	Tank, 90-mm gun.....	77	64.5	3	231			60	11,610.00	17	3,289.50	14,899.50
71	Gun, machine, cal .50, per tank.....	605	.39	3	1,815			500	585.00	105	122.85	707.85
72	Grenade, hand, per tank.....	8	2.1	24	24			24	50.40			50.40
73	Gun, machine, cal .30, on tank.....	6,650	.086	3	19,950			5,900	1,522.20	750	193.50	1,715.70
74	Mine, AP, M14.....		.20		1,800					1,800	360.00	360.00
75	Flare, candle, M49.....		1.5		48					48	72.00	72.00
76	Flare, trip, M48.....		8.8		48					48	422.40	422.40
<i>Sig Bn (TOE 11-5T)</i>												
77	Pistol, auto, cal .45.....	21	.057	9	189	21	10.77					10.77
78	Rifle, US, cal .30.....	96	.095	199	19,104	48	907.44	48	907.44			1,814.88
79	Carbine, cal .30.....	90	.036	209	18,810	60	451.44	30	225.72			677.16
80	Gun, submachine, cal .45.....	90	.057	108	9,720	30	184.68	60	369.36			554.04
81	Launcher, rocket, 3.5-in.....	4	17.7	19	76			4	1,345.20			1,345.20
82	Gun, machine, cal .30, M1919A4.....	2,000	.086	5	10,000	250	107.50	750	322.50	1,000	430.00	860.00
83	Grenade, hand.....		2.1		400	300	630.00			100	210.00	840.00
84	Launcher, grenade, rifle.....	20	6.9	5	100	2	69.00	8	276.00	10	345.00	690.00
85	Gun, machine, cal .50, HB.....	530	.39	12	6,360			530	2,480.40			2,480.40
												9,272.45 = 4.64 tons

766,640.51 = 383.32 tons

96,284.26 = 48.14 tons

See footnotes at end of table.

	1	2	3	4	5	6	7	8	9	10	11	12
1	Unit and type munition	Rnd per wpn	Wt per rnd (lb)	Total wpn	Total rnd	Carried on individual		Carried on vehicle		Bulk loaded		Total wt (lb)
						Rnd per wpn	Total wt (lb)	Rnd per wpn	Total wt (lb)	Rnd per wpn	Total wt (lb)	
	<i>Div Hq & Hq Co (TOE 7-2T)</i>											
86	Pistol, auto, cal .45-----	21	.057	55	1,155	21	65.84					65.84
87	Carbine, cal .30-----	90	.036	111	9,990	60	239.76	30	119.88			359.64
88	Gun, submachine, cal .45-----	90	.057	18	1,620	30	30.78	60	61.56			92.34
89	Rifle, US, cal .30-----	96	.095	101	9,696	48	460.56	48	460.56			921.12
90	Rifle, auto, cal .30, Bng-----	500	.086	5	2,500	180	77.40	320	137.60			215.00
91	Gun, machine, cal .30, M1919A6.	2,000	.086	8	16,000	250	172.00	750	516.00	1,000	688.00	1,376.00
92	Launcher, rocket, 3.5-in.-----	4	17.7	11	44			4	778.8			778.8
93	Grenade, hand-----		2.1		200	200	420.00					420.0
94	Launcher, grenade, rifle-----	20	6.9	5	100			10	345.00	10	345.00	690.00
												4,918.74= 2.46 tons
	<i>Admin Co (TOE 12-7T)</i>											
95	Pistol, auto, cal .45-----	21	.057	11	231	21	13.17					13.17
96	Rifle, US, cal .30-----	96	.095	25	2,400	48	114.00	48	114.00			228.00
97	Carbine, cal .30-----	90	.036	123	11,070	60	265.68	30	132.84			398.52
98	Gun, submachine, cal .45-----	90	.057	3	270	30	5.13	60	10.26			15.39
99	Gun, machine, cal .30, M1919A6.	2,000	.086	4	8,000	250	86.00	750	258.00	1,000	344.00	688.00
100	Gun, machine, cal .50-----	530	.39	1	530			530	206.70			206.70
101	Grenade, hand-----		2.1		50					50	105.00	105.00
102	Launcher, grenade, rifle-----	20	6.9	9	180			10	621.00	1.0	621.00	1,242.00
103	Launcher, rocket, 3.5-in.-----	4	17.7	2	8			4	141.6			141.6
												3,038.38=1.52 tons
	<i>Avn Co (TOE 1-7T)</i>											
104	Pistol, auto, cal .45-----	21	.057	69	1,449	21	82.59					82.59
105	Rifle, US, cal .30-----	96	.095	71	6,816	48	323.76	48	323.76			647.52
106	Carbine, cal .30-----	90	.036	83	7,470	60	179.28	30	89.64			268.92
107	Grenade, hand-----		2.1		100			100	210.00			210.00
108	Gun, machine, cal .30, M1919A4.	2,000	.086	4	8,000	250	86.00	750	258.00	1,000	344.00	688.00
109	Gun, machine, cal .50-----	530	.39	2	1,060			530	413.40			413.40
110	Launcher, rocket, 3.5-in.-----	4	17.7	4	16			4	283.2			283.20

2,593.63 = 1.30
tons*Cav Sq (TOE 17-85T)*

111	Pistol, auto, cal .45	21	.057	185	3,885	21	221.45					221.45
112	Rifle, US, cal .30	120	.095	298	35,760	48	1,358.88	48	1,358.88	24	679.44	3,397.20
113	Carbine, cal .30	120	.036	113	13,560	60	244.08	30	122.04	30	122.04	488.16
114	Gun, submachine, cal .45	120	.058	109	13,080	60	379.32	60	379.32			758.64
115	Rifle, auto, cal .30, Bng	1,000	.086	18	18,000	60	92.88	480	743.04	460	712.08	1,548.00
116	Gun, machine, cal .50	630	.39	15	9,450			525	3,071.25	105	614.25	3,685.50
117	Mortar, 81-mm	95	15(avg)	9	855			95	12,825.00			12,825.00
118	Launcher, rocket, 3.5-in.	14	17.7	21	294			12	4,460.40	2	743.40	5,203.80
119	Gun, machine, cal .30, M1919A4	3,000	.09	47	141,000			1,500	6,345.00	1,500	6,345.00	12,690.00
120	Grenade, hand		2.1		700	300	630.00	400	840.00			1,470.00
121	Tank, 76-mm gun	70	34	23	1,610			65	50,830.00	5	3,910.00	54,740.00
122	Gun, machine, cal .50, on tank	573	.39	23	16,905			630	5,651.10	105	941.85	6,592.95
123	Grenade, hand, in vehicles ³	(³)	2.1	59	8,561				1,797.81			1,797.81
124	Gun, machine, cal .50, on pers carr.	1,995	.386	32	63,840			1,995	24,642.24			24,642.24
125	Launcher, grenade, rifle	6	3.02	36	216			5	543.60	1	108.72	652.32
126	Mine, AT, HE (hv), M15		40.00		346			96	3,840.00	250	10,000.00	13,840.00
127	Mine, AP, M14		.489		450					450	220.05	220.05
128	Mine, AP, M16		9.23		52					52	479.96	479.96
129	Demolition set No. 5	50	.40	16					20.00		30.00	50.00
130	Flares, signal, ground ⁴	(⁴)	Negl		340			340	Negl			

145,303.08 = 72.65
tons*Hq & Hq Det & Band,
Inf Div Tn (TOE 7-62T)*

131	Pistol, auto, cal .45	21	.057	3	63	21	3.59					3.59
132	Rifle, US, cal .30	96	.095	7	672	48	31.92	48	31.92			63.84
133	Carbine, cal .30	90	.036	53	4,770	60	114.48	30	57.24			171.72
134	Gun, submachine, cal .45	90	.057	5	450	30	8.55	60	17.10			25.65
135	Grenade, hand		2.1		100	100	210.00					210.00

474.80 = .24
tons*Ord Bn (TOE 9-25T)*

136	Pistol, auto, cal .45	21	.057	8	168	21	9.58					9.58
137	Rifle, US, cal .30	96	.095	108	10,368	48	492.48	48	492.48			984.96
138	Carbine, cal .30	90	.036	190	17,100	60	410.40	30	205.20			615.60

See footnotes at end of table.

	1	2	3	4	5	6	7	8	9	10	11	12
1	Unit and type munition	Rnd per wpn	Wt per rnd (lb)	Total wpn	Total rnd	Carried on individual		Carried on vehicle		Bulk loaded		Total wt (lb)
						Rnd per wpn	Total wt (lb)	Rnd per wpn	Total wt (lb)	Rnd per wpn	Total wt (lb)	
	<i>Ord Bn (TOE 9-25T)—Cont.</i>											
139	Gun, submachine, cal .45-----	90	.057	23	2,070	30	39.33	60	78.66	-----	-----	117.99
140	Gun, machine, cal .30, M1919A4.	2,000	.086	11	22,000	250	236.50	750	709.50	1,000	946.00	1,892.00
141	Gun, machine, cal .50-----	530	.39	14	7,420	-----	-----	530	2,893.80	-----	-----	2,893.80
142	Launcher, rocket, 3.5-in.-----	4	17.7	6	24	-----	-----	4	424.80	-----	-----	424.80
143	Gun, machine, cal .50, on pers carr.	530	.39	6	3,180	-----	-----	530	1,240.20	-----	-----	1,240.20
												8,178.93 = 4.09 tons
	<i>Med Bn (TOE 8-15T)</i>											
144	Pistol, auto, cal .45-----	21	.057	21	441	21	25.14	-----	-----	-----	-----	25.14
145	Rifle, US, cal .30-----	96	.095	27	2,592	48	123.12	48	123.12	-----	-----	246.24
146	Carbine, cal .30-----	90	.036	254	22,860	60	548.64	30	274.32	-----	-----	822.96
												1,094.34 = .55 tons
	<i>Trans Bn (TOE 55-75T)</i>											
147	Pistol, auto, cal .45-----	21	.057	3	63	21	3.59	-----	-----	-----	-----	3.59
148	Rifle, US, cal .30-----	96	.095	225	21,600	48	1,026.00	48	1,026.00	-----	-----	2,052.00
149	Carbine, cal .30-----	90	.036	304	27,360	60	656.64	30	328.32	-----	-----	984.96
150	Grenade, hand-----	-----	2.1	-----	300	-----	-----	300	630.00	-----	-----	630.00
151	Gun, machine, cal .50, on pers carr.	530	.39	115	60,950	-----	-----	530	23,770.50	-----	-----	23,770.50
152	Gun, machine, cal .30, M1919A6.	2,000	.095	16	32,000	-----	-----	1,000	1,520.00	1,000	1,520.00	3,040.00
153	Launcher, rocket, 3.5-in.-----	4	17.7	8	32	-----	-----	4	566.4	-----	-----	566.40
												31,047.45 = 15.52 tons
	<i>QM Co (TOE 10-17T)</i>											
154	Pistol, auto, cal .45-----	21	.057	2	42	21	2.39	-----	-----	-----	-----	2.39
155	Rifle, US, cal .30-----	96	.095	48	4,608	48	218.88	48	218.88	-----	-----	437.76
156	Carbine, cal .30-----	90	.036	142	12,780	60	306.72	30	153.36	-----	-----	460.08
157	Gun, submachine, cal .45-----	90	.057	2	180	30	3.42	60	6.84	-----	-----	10.26
158	Gun, machine, cal .50-----	530	.39	5	2,650	-----	-----	530	1,033.50	-----	-----	1,033.50
159	Launcher, rocket, 3.5-in.-----	4	17.7	2	8	-----	-----	4	141.60	-----	-----	141.60

160	Grenade, hand-----		2.1		50			50	105.00			105.00
												2,190.59 = 1.10 tons
	Total tons for division-----											1,422.82 tons

¹ 8/tank, M48—20/carrier personnel—8/vehicle, tank recovery.

² 12/tank, M48—12/carrier personnel—16/vehicle, tank recovery.

³ 8/tank, 76-mm, and vehicle tank recovery—20/carrier personnel.

⁴ 12/tank, 76-mm, and carrier personnel—16/vehicle, tank recovery.

5.34. Ammunition Supply Data—Armored Units—Nondivisional—Basic Load

	1	2	3 ¹	4		5 ³		
1	Weapon (unit)	Rounds per weapon	No. of weapons ²	Total basic load		How carried		
				Rounds	Tons	Individual	Vehicle ⁴	Trains
	HQ & HQ CO, ARMD CAV REGT (TOE 17-52R)							
2	Carbine, cal .30	90	64	5,760	.096	45	30	15
3	Gun, machine, cal .30, Bng	2,000	4	8,000	.308		1,000	1,000
4	Gun, machine, cal .50, HB, Bng	525	3	1,575	.291		420	105
5	Gun, submachine, cal .45 ⁵	160	46	7,360	.202	40	60	66
6	Launcher, rocket, 3.5-in.	12	11	132	.567		6	6
7	Pistol, auto, cal .45	21	23	483	.013	21		
8	Rifle, auto, cal .30	1,500	3	4,500	.169	60	480	960
9	Rifle, US, cal .30	120	53	6,360	.274	48	48	24
10	Total				1.920			
	SVC CO, ARMD CAV REGT (TOE 17-53R)							
11	Carbine, cal .30	90	79	7,110	.118	45	30	15
12	Gun, machine, cal .30, Bng	4,000	17	68,000	2.618		2,000	2,000
13	Gun, machine, cal .50, HB, Bng	840	17	14,280	2.642		672	168
14	Gun, submachine, cal .45 ⁵	160	97	15,520	.427	45	60	55
15	Launcher, rocket, 3.5-in.	12	20	240	1.126		6	6
16	Pistol, auto, cal .45	21	1	21	Negl	21		
17	Rifle, US, cal .30	120	45	5,400	.232	48	48	24
18	Total				7.164			
	ARMD CAV RECON BN, ARMD CAV REGT (TOE 17-55R)							
19	Carbine, cal .30	90	352	31,680	.523	45	30	15
20	Gun, machine, cal .30, Bng	4,000	34	136,000	5.251		1,500	2,500
21	Gun, machine, cal .50, HB, Bng	840	18	15,120	2.799		525	315
22	Howitzer, 105-mm, SP	250	6	1,500	37.50		60	190
23	Gun, submachine, cal .45 ⁵	160	146	23,360	.644	40	60	60
24	Launcher, grenade, M7A2 ⁶	6	36	216	.740		5	1
25	Launcher, rocket, 3.5-in.	12	40	480	2.250		6	6
26	Mortar, 81-mm, SP	120	9	1,080	5.238		97	23
27	Pistol, auto, cal .45	21	205	4,305	.119	21		
28	Rifle, auto, cal .30	1,000	9	9,000	.338	60	480	460
29	Rifle, US, cal .30	120	231	27,720	1.194	48	48	24
30	Sniperscope (carbine)	90	9	810	.010	45	30	15
31	Demolition equipment set, explosive initiating, electric and non- electric.		3		Negl		X	
32	Total				19.106			
	HQ & HQ CO, ARMOR GP (TOE 17-32R)							
33	Carbine, cal .30	90	27	2,430	.041	45	30	15
34	Gun, machine, cal .50, HB, Bng	525	5	2,625	.486		420	105
35	Gun, submachine, cal .45 ⁵	160	15	2,400	.066	40	60	60
36	Launcher, grenade, M7A3 ⁶	6	6	36	.120		5	1
37	Launcher, rocket, 3.5-in.	12	4	48	.224		6	6
38	Pistol, auto, cal .45	21	7	84	.004	21		
39	Rifle, US, cal .30	120	14	1,680	.072	48	48	24
40	Total				1.013			

See footnotes at end of table.

	1	2	3 ¹	4		5 ²		
1	Weapon (unit)	Rounds per weapon	No. of weapons ²	Total basic load		How carried		
				Rounds	Tons	Individual	Vehicle ⁴	Trains
	TK BN, 90-mm GUN, NON-DIV (TOE 17-25C)							
41	Carbine, cal .30-----	120	278	33,360	.601	60	30	30
42	Gun, machine, cal .30, Bng-----	3,250	18	58,500	2.258	-----	1,000	2,250
43	Gun, machine, cal .50, HB, Bng-----	525	16	8,400	1.638	-----	315	210
44	Gun, submachine, cal .45-----	120	167	20,040	.571	30	60	30
45	Launcher, rkt, 3.5-in-----	9	22	198	1.725	-----	6	3
46	Mortar, SP, 4.2-in-----	144	4	576	9.792	-----	74	74
47	Mortar, SP, 81-mm-----	120	1	120	.582	-----	97	23
48	Pistol, auto, cal .45-----	21	392	8,232	.219	21	-----	-----
49	Rifle, auto, cal .30-----	1,000	1	1,000	.043	60	480	460
50	Rifle, US, cal .30-----	120	30	3,600	.155	48	48	24
	TK BN, 120-mm GUN, NON-DIV (TOE 17-35C)							
51	Carbine, cal .30-----	85	260	22,100	.364	45	15	25
52	Gun, machine, cal .30, Bng-----	3,250	18	58,500	2.258	-----	1,000	2,250
53	Gun, machine, cal .50, HB, Bng-----	525	14	7,350	1.359	-----	525	-----
54	Gun, submachine, cal .45 ⁵ -----	100	168	16,800	.462	-----	60	40
55	Launcher, grenade, M7A3 ⁶ -----	10	4	40	.140	-----	5	5
56	Launcher, rocket, 3.5-in-----	9	20	180	.844	-----	6	3
57	Mortar, 81-mm, SP-----	120	1	120	.582	-----	97	23
58	Pistol, auto, cal .45-----	21	375	7,875	.218	21	-----	-----
59	Rifle, auto, cal .30-----	1,500	1	1,500	.056	60	480	960
60	Rifle, US, cal .30-----	120	30	3,600	.155	48	48	20
61	Mortar, 4.2-in., SP-----	144	4	576	9.792	-----	74	10
62	Demolition equipment set, explosive initiating, electric and non- electric.	-----	1	-----	Negl	-----	X	-----
63	Mines, AT, M6A2-----	-----	-----	200	3.200	-----	-----	200
64	Total-----	-----	-----	-----	19.430	-----	-----	-----
	AMPH TK BN (TOE 17-115R)							
65	Carbine, cal .30-----	90	309	27,810	.460	45	45	-----
66	Gun, machine, cal .50, HB, Bng-----	525	8	4,200	.777	-----	525	-----
67	Gun, submachine, cal .45 ⁵ -----	100	172	17,200	.473	40	60	-----
68	Launcher, rocket, 3.5-in-----	12	19	228	1.069	-----	12	-----
69	Pistol, auto, cal .45-----	21	436	9,156	.252	21	-----	-----
70	Rifle, US, cal .30-----	120	3	360	.015	48	68	-----
71	Total-----	-----	-----	-----	3.046	-----	-----	-----
	AMPH TRAC BN (TOE 17-125R)							
72	Carbine, cal .30-----	90	292	26,280	.432	45	45	-----
73	Gun, machine, cal .50, HB, Bng-----	525	4	2,100	.389	-----	525	-----
74	Gun, submachine, cal .45 ⁵ -----	100	25	2,500	.069	40	60	-----
75	Launcher, rocket, 3.5-in-----	12	11	132	.619	-----	12	-----
76	Pistol, auto, cal .45-----	21	334	7,014	.193	21	-----	-----
77	Rifle, US, cal .30-----	120	2	240	.010	48	68	-----
78	Total-----	-----	-----	-----	1.712	-----	-----	-----

¹ Weapons listed on standard nomenclature lists (SNL) for vehicles as OVM equipment must be included in the computation of the total basic load of a unit. Necessary information is obtained from paragraph 5.28 or from appropriate SNL (or technical manual) if vehicle is not listed.

² Individual weapons computations are based on "Remarks" column contained in the latest changes to section II of the appropriate table of organization and equipment for those units for which such changes have been issued.

³ This column indicates a suggested distribution only and is not restrictive.

⁴ Includes trailer with towing vehicle when appropriate.

⁵ When vehicular stowage provides space for a greater number of rounds for gun, submachine, cal .45, than indicated in this table, the full stowage capacity will be used in computing the basic load of the unit.

⁶ "Rounds per weapon" includes both the cartridge and the grenade.

5.35. Ammunition Supply Data—Artillery Units

a. Basic Load.

(1) Field artillery.

	1	2	3	4		5		
1	Weapon (unit)	Rounds per weapon	No. of weapons	Total basic load		How carried		
				Rounds	Tons	Individual	Vehicle	Trains
	HQ & HQ BTRY, FA GP (TOE 6-401C)							
2	Carbine, cal .30	90	46	4,140	.075	45	45	
3	Gun, machine, cal .30, Bng	530	20	1,060	.046		530	
4	Gun, machine, cal .50, Bng HB,	530	2	1,060	.207		530	
5	Gun, submachine, cal .45	100	21	2,100	.060	40	60	
6	Launcher, rocket, 3.5-in.	6	3	18	.159	6		
7	Pistol, auto, cal .45	21	2	42	.001	21		
8	Rifle, US, cal .30	120	31	3,720	.177	48	48	24
9	Total				.725			
	HQ & HQ BTRY, CORPS ARTY (TOE 6-501C)							
10	Carbine, cal .30	90	82	7,380	.133	45	45	
11	Gun, machine, cal .30, Bng	530	2	1,060	.046		530	
12	Gun, machine, cal .50, Bng, HB	530	2	1,060	.207		530	
13	Gun, submachine, cal .45	90	40	3,600	.103	45	45	
14	Launcher, rocket, 3.5-in.	6	3	18	.159	6		
15	Pistol, auto, cal .45	21	17	357	.010	21		
16	Rifle, US, cal .30	120	31	3,720	.177	48	48	24
17	Total				.835			
	FA BN, 105-mm HOW, TOWED (TOE 6-125C)							
18	Carbine, cal .30	90	227	20,430	.398	45	45	
19	Gun, machine, cal .30, Bng	530	10	5,300	.228		530	
20	Gun, machine, cal .50, Bng, HB	530	20	10,600	2.670		530	
21	Gun, submachine, cal .45	90	62	5,580	.159	45	45	
22	Howitzer, 105-mm, on carriage	250	18	4,500	110.25		60	190
23	Launcher, rocket, 3.5-in.	6	38	228	2.018	6		
24	Pistol, auto, cal .45	21	11	231	.007	21		
25	Rifle, US, cal .30	120	270	32,400	1.539	48	48	24
26	Total				117.269			
	FA BN, 105-mm, HOW, SP, ARMD (TOE 6-315C)							
27	Carbine, cal .30	90	257	23,130	.416	45	45	
28	Gun, machine, cal .30, Bng	530	10	5,300	.228		530	
29	Gun, machine, cal .50, Bng, HB	530	14	7,420	1.342		530	
30	Gun, submachine, cal .45	90	63	5,670	.162	45	45	
31	Howitzer, 105-mm, SP	250	18	4,500	110.25		56	194
32	Launcher, rocket, 3.5-in.	6	39	234	2.071	6		
33	Pistol, auto, cal .45	21	10	210	.006	21		
34	Rifle, US, cal .30	120	290	34,800	1.653	48	48	24
35	Total				116.128			
	FA BN, 155-mm HOW, SP, ARMD (TOE 6-325C)							
36	Carbine, cal .30	90	204	18,360	.330	45	45	
37	Gun, machine, cal .30, Bng	530	10	5,300	.228		530	
38	Gun, machine, cal .50	530	13	6,890	1.339		530	

1	1	2	3	4		5		
	Weapon (unit)	Rounds per weapon	No. of weapons	Total basic load		How carried		
				Rounds	Tons	Individual	Vehicle	Trains
39	FA BN 155-mm HOW, SP, ARMD							
40	(TOE 6-325C)—Continued							
41	Gun, submachine, cal .45	90	49	4,410	.126	45	45	
42	Howitzer, 155-mm, SP	150	18	2,700	155.25		24	126
43	Launcher, rocket, 3.5-in.	6	35	210	1.859	6		
44	Pistol, auto, cal .45	21	10	210	.006	21		
	Rifle, US, cal .30	120	365	43,800	2.081	48	48	24
	Total				161.219			
45	FA BN, 155-mm GUN, TOWED							
46	(TOE 6-415R)							
47	Carbine, cal .30	90	149	13,410	.241	45	45	
48	Gun, machine, cal .30, Bng	530	10	5,300	.228		530	
49	Gun, machine, cal .50, Bng, HB	530	15	7,950	1.550		530	
50	Gun, submachine, cal .45	90	56	5,040	.148	45	45	
51	Gun, 155-mm, on carriage	120	12	1,440	138.24		30	90
52	Launcher, rocket, 3.5-in.	6	32	192	1.699	6		
53	Pistol, auto, cal .45	21	11	231	.007	21		
	Rifle, US, cal .30	120	357	42,840	1.985	48	48	24
	Total				144.098			
54	FA BN, 8-in. HOW, TOWED (TOE							
55	6-415R)							
56	Carbine, cal .30	90	149	13,410	.241	45	45	
57	Gun, machine, cal .30, Bng	530	10	5,300	.228		530	
58	Gun, machine, cal .50, Bng, HB	530	15	7,950	1.550		530	
59	Gun, submachine, cal .45	90	56	5,040	.148	45	45	
60	Howitzer, 8-in., on carriage ¹	100	12	1,200	141.60		20	80
61	Launcher, rocket, 3.5-in.	6	32	192	1.699	6		
62	Pistol, auto, cal .45	21	11	231	.007	21		
	Rifle, US, cal .30	120	357	42,840	1.985	48	48	24
	Total				147.458			
63								
64	FA OBSN BN (TOE 6-575C)							
65	Carbine, cal .30	90	285	25,650	.462	45	45	
66	Gun, machine, cal .30, Bng	530	8	4,240	.182		530	
67	Gun, machine, cal .50, Bng, HB	530	28	14,840	2.844		530	
68	Gun, submachine, cal .45	90	131	11,790	.336	45	45	
69	Launcher, rocket, 3.5-in.	6	21	126	1.115	6		
70	Pistol, auto, cal .45	21	12	252	.007	21		
	Rifle, US, cal .30	120	344	41,280	1.961	48	48	24
	Total				6.907			
71	FA BN, 8-in. HOW, SP (TOE							
72	6-435R)							
73	Carbine, cal .30	90	161	14,490	.261	45	45	
74	Gun, machine, cal .30, Bng	530	10	5,300	.228		530	
75	Gun, machine, cal .50, Bng, HB	530	15	7,950	1.550		530	
76	Gun, submachine, cal .45	90	56	5,040	.448	45	45	
77	Howitzer, 8-in., SP ¹	148	12	1,776	209.57		12	136
78	Launcher, rocket, 3.5-in.	6	32	192	1.699	6		
79	Pistol, auto, cal .45	21	11	231	.007	21		
	Rifle, US, cal .30	120	282	33,840	1.582	48	48	24
	Total				215.345			

See footnotes at end of table.

1	1	2	3	4		5		
	Weapon (unit)	Rounds per weapon	No. of weapons	Total basic load		How carried		
				Rounds	Tons	Individual	Vehicle	Trains
	FA BN, 155-mm GUN, SP (TOE 6-435R)							
80	Carbine, cal .30	90	161	14,490	.261	45	45	
81	Gun, machine, cal .30, Bng	530	10	5,300	.228		530	
82	Gun, machine, cal .50, Bng, HB	530	15	7,950	1.550		530	
83	Gun, submachine, cal .45	90	56	5,040	.448	45	45	
84	Gun, 155-mm, SP	173	12	2,076	199.29		20	153
85	Launcher, rocket, 3.5-in.	6	32	192	1.699	6		
86	Pistol, auto, cal .45	21	11	231	.007	21		
87	Rifle, US, cal .30	120	258	30,960	1.461	48	48	24
88	Total				204.944			
	FA RKT BN, 762-mm RKT, SP (TOE 6-625C)							
89	Carbine, cal .30	90	63	5,670	.102	45	45	
90	Gun, machine, cal .30, Bng	530	10	5,300	.228		530	
91	Gun, machine, cal .50, Bng, HB	530	4	2,120	.412		530	
92	Gun, submachine, cal .45	90	34	3,060	.087	45	45	
93	Launcher, 762-mm rkt, trk mtd ¹	(²)	4					
94	Launcher, rocket, 3.5-in.	6	9	54	.478	6		
95	Pistol, auto, cal .45	21	5	105	.003	21		
96	Rifle, US, cal .30	120	124	14,880	.701	48	48	24
97	Total ³				2.011			
	FA BN, 280-mm GUN (TOE 6-535C)							
98	Carbine, cal .30	90	255	22,950	.415	45	45	
99	Gun, 280-mm, on carriage ¹		6					
100	Gun, machine, cal .30, Bng	530	10	5,300	.228		530	
101	Gun, machine, cal .50, Bng, HB	530	8	4,240	.877		530	
102	Gun, submachine, cal .45	90	1	90	.002	45	45	
103	Launcher, rocket, 3.5-in.	6	21	126	1.115	6		
104	Pistol, auto, cal .45	21	12	252	.007	21		
105	Rifle, US, cal .30	120	198	23,760	1.151	48	48	24
106	Total ⁴				4.277			
	FA MSL BN, CPL (TOE 6-545D)							
107	Carbine, cal .30	90	152	13,680	.247	45	45	
108	Gun, machine, cal .30, Bng	530	11	5,830	.242		530	
109	Launcher, guided missile ¹		⁵ 2					
110	Launcher, rocket, 3.5-in.	6	13	78	.695	6		
111	Pistol, auto, cal .45	21	5	105	.003	21		
112	Rifle, US, cal .30	120	98	11,760	.559	48	48	24
113	Total ⁶				1.746			
	FA MSL BN, LACROSSE (TOE 6-585T)							
114	Carbine, cal .30	90	125	11,250	.204	45	45	
115	Gun, machine, cal .30, Bng	530	12	6,360	.275		530	
116	Launcher, XM938, LACROSSE ¹		4					
117	Launcher, rocket, 3.5-in.	6	13	78	.695	6		
118	Pistol, auto, cal .45	21	8	168	.005	21		
119	Rifle, US, cal .30	120	97	11,640	.547	48	48	24
120	Total ⁷				1.720			

See footnotes at end of table.

1	1	2	3	4		5		
	Weapon (unit)	Rounds per weapon	No. of weapons	Total basic load		How carried		
				Rounds	Tons	Individual	Vehicle	Trains
	FA MSL BN, REDSTONE (TOE 6-635D)							
121	Carbine, cal .30	90	115	10,350	.186	45	45	
122	Gun, machine, cal .30, Bng	530	5	2,650	.114		530	
123	Gun, machine, cal .50, Bng, HB	530	8	4,240	.828		530	
124	Launcher, guided missile, XM 30 ¹		2					
125	Launcher, rocket, 3.5-in.	6	13	78	.695	6		
126	Pistol, auto, cal .45	21	6	126	.004	21		
127	Rifle, US, cal .30	120	85	10,200	.484	48	48	24
128	Total ⁸				2.311			

¹ See FM 101-10, part III (when published).

² See FM 6-61A.

³ Does not include line 93.

⁴ Does not include line 99.

⁵ Two launchers, operational; 1 spare launcher in firing battery headquarters.

⁶ Does not include line 109.

⁷ Does not include line 116.

⁸ Does not include line 124.

(2) Air defense artillery.

1	1	2	3	4		5		
	Weapon (unit)	Rounds per weapon	No. of weapons	Total basic load		How carried		
				Rounds	Tons	Individual	Vehicle	Trains
	HQ & HQ BTRY, AAA BDE, MBL (TOE 44-101C)							
2	Carbine, cal .30	90	82	7,380	.133	45	45	
3	Gun, machine, cal .50, Bng, HB	530	7	3,710	.723		530	
4	Launcher, rocket, 3.5-in.	6	2	12	.106	6		
5	Pistol, auto, cal .45	21	8	168	.005	21		
6	Rifle, US, cal .30	120	55	6,600	.314	48	72	
7	Total				1.281			
	HQ & HQ BTRY, AAA GP, MBL (TOE 44-12C)							
8	Carbine, cal .30	90	79	7,110	.128	45	45	
9	Gun, machine, cal .50, Bng, HB	530	7	3,710	.723		530	
10	Launcher, rocket, 3.5-in.	6	4	24	.113	6		
11	Pistol, auto, cal .45	21	7	147	.004	21		
12	Rifle, US, cal .30	120	50	6,000	.285	48	72	
13	Total				1.253			
	AAA DET OP (TOE 44-7R)							
14	Carbine, cal .30	90	19	1,710	.031	45	45	
15	Gun, machine, cal .50, Bng, HB	530	1	530	.103		530	
16	Gun, submachine, cal .45	90	9	810	.022	45	45	
17	Launcher, rocket, 3.5-in.	6	1	6	.053		6	
18	Pistol, auto, cal .45	21	1	21	Negl	21		
19	Rifle, US, cal .30	120	24	2,880	.137	48	72	
20	Total				.346			

1	1	2	3	4		5		
	Weapon (unit)	Rounds per weapon	No. of weapons	Total basic load		How carried		
				Rounds	Tons	Individual	Vehicle	Trains
	AAA BN, 90-mm GUN, MBL (TOE 44-15C)							
21	Carbine, cal .30	90	319	28,710	.510	45	45	
22	Gun, machine, cal .50, Bng, HB	530	42	22,260	4.338		530	
23	Gun, 90-mm, on mount	175	16	2,800	95.200		155	20
24	Launcher, rocket, 3.5-in.	6	22	132	1.168		6	
25	Mount, tlr, multiple, cal .50 machinegun.	4,240	16	67,840	12.467		3,445	795
26	Pistol, auto, cal .45	21	3	63	.002	21		
27	Rifle, US, cal .30	120	335	40,200	1.910	48	72	
28	Total				115.595			
	AAA BN, 120-mm GUN, SMBL (TOE 44-115C) ¹							
29	Carbine, cal .30	90	329	29,610	.528	45	45	
30	Gun, machine, cal .50, Bng, HB	530	25	13,250	2.451		530	
31	Gun, 120-mm, on mount	90	16	1,440	104.400		40	50
32	Launcher, rocket, 3.5-in.	6	22	132	1.168		6	
33	Mount, tlr, multiple, cal .50 machinegun.	4,240	16	67,840	12.467		4,240	
34	Pistol, auto, cal .45	21	3	63	.002	21		
35	Rifle, US, cal .30	120	269	32,280	1.533	48	72	
36	Total				122.549			
	AAA BN, AW, MBL (TOE 44-25C)							
37	Carbine, cal .30	90	245	22,050	.397	45	45	
38	Gun, machine, cal .50, Bng, HB	530	30	15,900	2.942		530	
39	Gun, submachine, cal .45	90	148	13,320	.380	45	45	
40	Gun, auto, 40-mm, on carriage	300	32	9,600	31.680		240	60
41	Launcher, rocket, 3.5-in.	6	52	312	1.463		6	
42	Mount, tlr, multiple, cal .50 machinegun.	6,000	32	192,000	35.520		4,800	1,200
43	Pistol, auto, cal .45	21	4	84	.002	21		
44	Rifle, US, cal .30	120	253	30,360	1.442	48	72	
45	Total				73.826			
	AAA BN, AW, SP (TOE 44-75C)							
46	Carbine, cal .30	90	553	49,770	.896	45	45	
47	Gun, machine, cal .50, Bng, HB	530	13	6,890	1.344		530	
48	Gun, submachine, cal .45	90	138	12,420	.353	45	45	
49	Gun, multiple, cal .50, SP	7,200	32	230,550	42.369		5,875	1,325
50	Gun, twin, 40-mm, SP	720	32	23,040	76.032		560	160
51	Launcher, rocket, 3.5-in.	6	52	312	1.463		6	
52	Pistol, auto, cal .45	21	4	84	.002	21		
53	Rifle, US, cal .30	120	2	240	.011	48	72	
54	Total				122.470			
	ABN AAA BN, AW (TOE 44-275C)							
55	Carbine, cal .30	90	323	29,070	.523	45	45	
56	Gun, machine, cal .50, Bng, HB	530	6	3,180	.620		530	
57	Gun, submachine, cal .45	90	147	13,230	.377	45	45	
58	Gun, twin, 40-mm, SP	264	24	6,336	20.988		144	120
59	Launcher, rocket, 3.5-in.	6	82	492	4.354	6		
60	Mount, tlr, multiple, cal .50 machinegun.	5,300	48	254,000	46.752		3,180	2,120
61	Pistol, auto, cal .45	21	3	63	.002	21		

See footnotes at end of table.

	1	2	3	4		5		
1	Weapon (unit)	Rounds per weapon	No. of weapons	Total basic load		How carried		
				Rounds	Tons	Individual	Vehicle	Trains
	ABN AAA BN, AW (TOE 44-275C) —Continued							
62	Rifle, US, cal .50-----	120	186	22,320	1.060	48	72	-----
63	Total-----				74.678			-----
	AAA BN, 75-mm GUN, MBL (TOE 44-35C)							
64	Carbine, cal .30-----	90	154	13,860	.250	45	45	-----
65	Gun, machine, cal .50, Bng, HB---	530	32	16,960	3.140	530		-----
66	Gun, 75-mm, on mount-----	200	18	3,600	60.300		130	70
67	Launcher, rocket, 3.5-in.-----	6	23	138	1.171		6	-----
68	Pistol, cal .45-----	21	4	84	.003	21		-----
69	Rifle, US, cal .30-----	120	276	32,120	1.526	48	72	-----
70	Total-----				66.290			-----
	AD ARTY MSL BN, NIKE-AJAX (TOE 44-145D)							
71	Carbine, cal .30-----	90	368	33,220	.589	45	45	-----
72	Gun, machine, cal .50, Bng, M2, hv barrel, flex, w/eqp.	530	37	19,610	3.826		530	-----
73	Gun, submachine, cal .45-----	90	76	6,840	.198	45	45	-----
74	Launcher-loader, GM/NIKE I ² ---		36					-----
75	Launcher, rocket, 3.5-in.-----	6	36	216	1.012		6	-----
76	Pistol, auto, cal .45-----	21	4	84	.002	21		-----
77	Total ³ -----				5.627			-----

¹ AAA bn, 120-mm gun, semimobile, TOE 44-115, has sufficient organic transportation to move a single battery as a unit. Therefore, ammunition for only 1 battery can be transported at 1 time with the organic transportation.

² See FM 101-10, part III (when published).

³ Does not include line 74.

b. Resupply Capacity, Organic Ammunition Vehicles. (Prime movers of weapons and weapon carriers not included.)

1	2	3	4	5	6	7	8
Unit	Truck, 2½-ton, and trailer, 1½-ton	Truck, 2½-ton, and trailer, M10A1 ¹	Truck, cargo, 5-ton	Truck, cargo, 5-ton, and trailer, 1½-ton	Truck, cargo, 5-ton, and trailer, M10A1 ¹	Tractor, M5A4, ² and trailer, M10A1 ¹	Capacity (tons)
2 FA bn, 105-mm howitzer, towed		21					81.27
3 FA bn, 105-mm howitzer, SP, armored		21					81.27
4 FA bn, 155-mm howitzer, towed		12			9	3	103.00
5 FA bn, 155-mm howitzer, SP, armored		12			18		143.10
6 FA bn, 155-mm gun, towed			6	12			120.00
7 FA bn, 155-mm gun, SP			6		12		136.44
8 FA bn, 8-in. howitzer, towed			6	12			120.00
9 FA bn, 8-in. howitzer, SP			6		12		136.44
10 FA bn, 280-mm gun	(³)		16				120.00

¹Trailer, M10A1, carries 1.37 tons ammunition (56 rounds 105-mm, 23 rounds 155-mm).

²Tractor, M5, carries 24 rounds 155-mm ammunition (1.38 tons), 58 rounds 105-mm (1.38 tons).

³4 trucks, 20 trailers.

5.36. Ammunition Supply Data—Chemical Units

1	1	2	3	4		5		
	Weapon (unit)	Rounds per weapon	No. of weapons	Total basic load		How carried		
				Rounds	Tons	Individual	Vehicle	Trains
	HQ & HQ DET, CML SMK GENR BN (TOE 3-266R)							
2	Carbine, cal .30.....	90	13	1,170	.020	60		30
3	Pistol, auto, cal .45.....	21	2	42		21		
4	Rifle, US, cal .30.....	96	6	576	.026	48	48	
5	Gun, submachine, cal .45.....	90	1	90		90		
6	Total.....				.046			
	CML SMK GENR CO (TOE 3-267R)							
7	Carbine, cal .30.....	90	96	8,640	.143	60		30
8	Gun, machine, cal .50, Bng.....	530	2	1,060	.196		530	
9	Gun, machine, cal .30, Bng, HB.....	2,000	4	8,000	.308		2,000	
10	Launcher, grenade, rifle.....	10	13	130	.100		10	
11	Launcher, rocket, 3.5-in.....	6	4	24	.113		6	
12	Rifle, auto, cal .30, Bng.....	500	5	2,500	.094	180	320	
13	Rifle, US, cal .30.....	96	23	2,208	.095	48	48	
14	Gun, submachine, cal .45.....	90	15	1,350	.038	60	30	
15	Generator, smoke, mech, pulse-jet, M3 series ¹ .	² 4 ³ 4	48	² 192 ³ 144	43.76 2.01		² 130 ³ 48	² 62 ³ 96
16	Total.....				46.86			

¹ A single mechanical smoke generator operating at maximum capacity consumes approximately 1,200 gallons of fog oil per 24-hour day.

² 55-gallon drum (fog oil).

³ 5-gallon gas cans (80-octane gas).

5.37. Ammunition Supply Data—Engineers

1	1	2	3	4		5		
	Weapon (unit)	Rounds per weapon	No. of weapons	Total basic load		How carried		
				Rounds	Tons	Individual	Vehicle	Trains
	ENGR CMBT BN, ARMY (TOE 5-35R)							
2	Carbine, cal .30.....	60	100	6,000	.108	60		
3	Gun, machine, cal .30, Bng.....	1,000	20	20,000	.770		1,000	
4	Gun, machine, cal .50, Bng, HB.....	530	18	9,540	1.765		530	
5	Gun, submachine, cal .45.....	90	37	3,330	.092	60	30	
6	Launcher, grenade, rifle.....	20	92	1,840	6.348		10	10
7	Launcher, rocket, 3.5-in.....	12	31	372	1.745		12	
8	Pistol, auto, cal .45.....	21	5	105	.002	21		
9	Rifle, US, cal .30.....	96	495	47,520	2.043	48	48	
10	Total.....				12.873			

5.38. Ammunition Supply Data—Signal Corps

	1	2	3	4		5		
1	Weapon (unit)	Rounds per weapon	No. of weapons	Total basic load		How carried		
				Rounds	Tons	Individual	Vehicle	Trains
		SIG BN, CORPS (TOE 11-15D)						
2	Carbine, cal .30-----	60	763	47,780	.824	60		
3	Gun, machine, cal .50, Bng, HB-----	530	30	15,900	2.942		530	
4	Gun, submachine, cal .45-----	90	144	12,960	.356	60	30	
5	Launcher, rocket, 3.5-in.-----	4	32	128	.600		4	
6	Pistol, auto, cal .45-----	21	24	504	.012	21		
7	Rifle, US, cal .30-----	96	262	25,152	1.081	48	48	
8	Total-----				5.815			

5.39. Ammunition Supply Data—Service Units

For planning purposes, assume service units not likely to become involved in direct combat with the enemy, to carry a basic load of ammunition as follows:

1	2
	Rounds per weapon
Weapon	
2 Carbine, cal .30-----	60
3 Rifle, cal .30-----	96
4 Weapons to be used against hostile aircraft ¹ ---	530

¹ Machineguns, cal .50 and cal .30.

Section VI. MISCELLANEOUS SUPPLY

5.40. Water Supply

a. Water Requirements.

	1	2	3	4
1	Unit consumer	Conditions of use	Gallons per unit consumer per day ¹	Remarks
2	Man	In combat:		For periods not exceeding 3 days—
		Minimum	$\frac{1}{2}$ –1	When operational rations are used.
		Normal	2	When field rations are used.
		March or bivouac	3	Drinking plus small amount for cooking or personal hygiene.
		Temporary camp	2	Minimum for all purposes.
		Temporary camp with bathing facilities.	5	Desirable for all purposes (does not include bathing).
		Semipermanent camp	15	Includes allowance for waterborne sewage system.
		Permanent camp	30–60	
		Level and rolling country	60–100	
3	Vehicle	Mountainous country	$\frac{1}{8}$ – $\frac{1}{2}$	Depending on size of vehicle.
4	Locomotive	Standard military	$\frac{1}{4}$ –1	Depending on size of vehicle.
		Commercial	Variable	150 gallons per train mile.
5	Hospital	Drinking and cooking	Variable	200 gallons per train mile.
		With waterborne sewage	10 per bed	Minimum; does not include bathing or water for flushing.
6	Smoke generator, M2 series.	Semimobile	50 per bed	Includes water for medical personnel.
7	Impregnating plant, clothing, M2A1.	Maximum impregnating capacity	150 gallons per day universally.	
		Maximum impregnating capacity	3,000	Aqueous process. Includes 4,000 gallons for plant operations and 400 gallons for washing and cleaning purposes.

¹ In hot climates, maximum requirements may exceed values given by 15 to 100 percent.

b. Water Equipment Issued to Engineer Units.

Unit	No. of sets (each set can equip one water point)	Equipment in each set						Total discharge (GPM)		Total storage capacity (gal) ²	Maximum daily production (gal) ³	Water transport equipment
		Filter	Pumps		Tanks							
			No.	Dis- charge (GPM)	No.	Capa- city (gal)	Pump ¹	Filtering				
Inf div & army engr bn.....	5	35 GPM portable diatomite.....	4	55	3	3,000	1,000	175	15,000	210,000	-----	
Armd div engr bn.....	5	35 GPM portable diatomite.....	4	55	3	3,000	1,000	175	15,000	210,000	-----	
Abn div engr bn.....	4	35 GPM portable diatomite.....	4	55	3	3,000	800	140	12,000	168,000	-----	
EASC.....	2	35 GPM portable diatomite.....	4	55	3	3,000	400	70	6,000	84,000	-----	
Engr cons bn.....	2	35 GPM portable diatomite.....	4	55	3	3,000	400	70	6,000	84,000	-----	
Engr topo bn (army).....	1	15 GPM pack diatomite.....	2	30	4	500	45	15	500	18,000	-----	
Engr topo co (corps).....	1	do.....	2	30	4	500	45	15	500	18,000	-----	
Engr hv cons bn.....	1	35 GPM portable diatomite.....	4	55	3	3,000	200	35	3,000	42,000	-----	
Engr water sup co.....	9	50 GPM portable diatomite.....	5	55	4	3,000	2,295	450	27,000	540,000	12 1,000-gal tank trucks. 4 1,500-gal semi- trailers.	
Well drilling team GE.....	2	Well drilling sets.									-----	
Water purification team GF.....	1	50 GPM portable diatomite.....	5	55	4	3,000	255	50	3,000	60,000	-----	
Water purification team GG.....	4	50 GPM portable diatomite.....	5	55	4	3,000	1,010	200	12,000	240,000	-----	
Water transport team GH.....											5 900-gal tankers.	

¹One pump at purification rate, others at full-rated capacity.²Within each set, only one tank is available for storage. The remaining tanks are used in the treatment process.³Since a part of the equipment is normally held in reserve, the maximum daily production is not normally attained.

c. Distillation Units.

	1	2	3	4	5	6	7	8	9	10	11	12
1	Type	Distillate capacity		Economy pounds distilled per lb fuel	Fuel required		Raw water required (GPH)	Mounting	Weight (lb)	Dimensions		
		GPH	GPD ¹		Type	GPH				Length	Width	Height
2	Thermo-compression.	60	1,200	100	Gasoline	1	130	Skid Trailer	4,300	7 ft 8 in.	4 ft 6 in.	5 ft 0 in.
3	Thermo-compression (Badger).	150	3,000	150	Gasoline	1.5	325	Skid	4,700	12 ft 7 in.	7 ft 0 in.	6 ft 2 in.
4	Thermo-compression (Cleaver-Brooks).	150	3,000	150	Gasoline	1.5	325	Skid	6,700	9 ft 6 in.	4 ft 0 in.	6 ft 3 in.
5	Thermo-compression.	300	6,000	200	Diesel	2.0	600	Skid	6,800	11 ft 2 in.	4 ft 2 in.	5 ft 6 in.
									13,600	9 ft ½ in.	5 ft 7 in.	6 ft 4 in.

¹The distillate capacity in GPD is calculated on the basis of the Corps of Engineers' 20-hour day.

d. Water Distribution Equipment.

Equipment	Capacity
Unit kitchen.....	5-gal cans, wt 50 lb (filled).
Unit kitchen.....	400-gal trailer, tank, water.
Trailer, cargo, 1½-ton.....	60 cans filled.
Truck, cargo, 2½-ton, 6 x 6.....	100 cans filled.
Truck, tank, water, 2½-ton, 6 x 6, 1,000-gal.	700 gallons.
Semitrailer, tank, water.....	1,500 gallons.

e. Filter Unit Characteristics.¹

Unit	Type	Output (GPM)	Weight (tons)	Cubage (cu ft)
Knapsack-pack.....	Paper pads	¼	7 lb	1
Pack diatomite, No. 2..	Diatomite	15	1.0	130
Portable diatomite, No. 3	Diatomite	35	1.8	160
Portable diatomite No. 4	Diatomite	50	2.9	270
Stationary diatomite, No. 6.	Diatomite	200	28	1,800

¹To be deleted or revised when development type sets are standardized or placed in the supply system.

f. Capacities of Other Water Supply Equipment.

Item	Capacity
Surface pump, centrifugal type, 2-inch suction and discharge ¹	55 GPM against total head of 50 feet including 15-foot suction lift.
Deep well pumps:	
Turbine type, 6-inch.....	200 GPM against 200-foot head.
Helical rotor type.....	60 GPM against 250-foot head.
Percussion well-drilling machine.....	4- to 6-inch well, 800 feet.
Rotary well-drilling machine.....	4- to 6-inch well, 1,000 feet.

¹Larger pumps available in depot stock and in special units.

5.41. Adjutant General Supplies

	1	2	3	4	5
1	Item	Pounds per man per day	Short tons per 1,000 men per month	Measurement tons per 1,000 men per month	Sacks or pouches of mail per 1,000 men per month
2	Forms and publications: Total, forms and publications.	0.033	0.5	1.0	-----
3	Postal: Letter mail ¹ -----	.028	.421	² 2.41	³ 24.0
4	Parcel post ⁴ -----	.166	2.49	⁵ 15.56	-----
5	Postal supplies-----	.011	.171	⁷ 0.6	-----
6	Total postal--	.205	3.082	18.57	⁶ 124.5

¹ Moved by air.

² Computed at 10 pouches per measurement ton (estimated).

³ Computed at 35 pounds per pouch of mail (estimated).

⁴ Volume may be expected to increase 2.3 times during October and November because of Christmas mail.

⁵ Computed at 8 sacks per measurement ton (estimated).

⁶ Computed at 40 pounds per sack of mail (estimated).

⁷ Conversion factor 3.5 measurement tons per short ton (estimated).

5.42. Army Exchange Supplies—Consumption and Replenishment

	1	2	3	4
1	Item	Pounds per man per day	Short tons per man per month	Measurement tons per man per month
2	Combat zone: Army in amphibious operations ¹ .	² 0.533	² 0.008	² 0.020
3	Theater: Pacific ³ ⁴ -----	1.571	.024	.050
4	European ⁴ ⁵ -----	1.428	.021	.043

¹ Based on Operation OLYMPIC estimates, 150-day period.

² Does not include sundries pack issued with rations, 0.369 pound per man per day.

³ Southwest Pacific Theater planning data, 1945.

⁴ Data do not include items procured locally by individual exchanges.

⁵ ETO Board Report.

5.43. Paper Supply

1	Unit consumer	Consumption tons per day	Maximum production per day	Remarks
2	Repro co ¹ (radio broadcast and leaflet bn)-----	11.25	4,500,000	5¼ in. x 8 in. leaflets printed both sides ³ .
3	Loudspeaker and leaflet co ² -----	5.0	2,000,000	5¼ in. x 8 in. leaflets printed both sides ³ .

¹ Based on press equipment authorized by TOE 33-57R.

² Based on press equipment authorized by TOE 33-77R.

³ For 8 in. x 10½ in. new sheets, production figures are divided by 2.

5.44. Special Services Supplies

	1	2	3
1	Item	Short tons per 10,000 men per month	Measurement tons per 10,000 men per month
2	Recreational: Books and magazines ¹ -----	.75	1.0
3	Sports ¹ -----	.75	2.0
4	Music, theatrical, crafts, and misc ¹ .	1.0	2.0
5	Total recreational ¹ -----	2.5	5.0
6	Donated items: Total donated items-----	.15	0.5

¹ Data do not include items procured locally nor items procured from any source with nonappropriated funds as defined in AR 230-5.

5.45. Entertainment Motion Picture Service Supplies

	1	2	3
1	Item	Short tons per 25,000 men per month	Measurement tons per 25,000 men per month
2	Total misc equipment and supplies.	.152	.247

Section VII. REQUIREMENTS

5.46. Day of Supply—Definitions

The day of supply, as used in this chapter, is the estimated weight of supplies required to support 1 man (soldier or officer, air plus ground) in an oversea theater for 1 day, based on total strengths and maintenance tonnage experience over a long period of time. These factors are not considered as including initial equipment of troop units, but they do include tonnages for project equipment and similar supplies (other than civilian or other relief supplies) which are required to support troops. *The tables shown in paragraphs 5.47 through 5.53 supplement the general consumption and flow charts of paragraph 5.47. They are based on historical data for specific locations, specific types of combat, and specific ground-to-air troop ratios. Data based on ROCID, ROCAD, and ROTAD divisions are not yet available.* For information on the establishment of ammunition day of supply and specification of theater stockage levels, see SB 38-26 and AR 11-8.

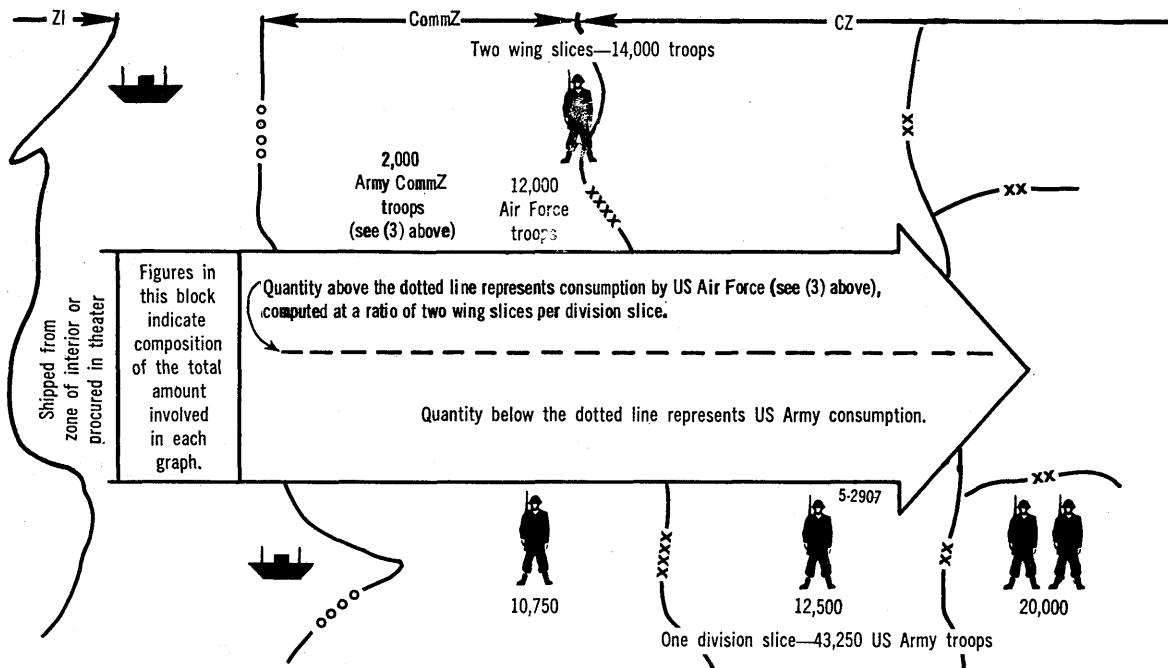
5.47. General Consumption and Flow Charts

a. Introduction and Explanation of Graphs.

- (1) This paragraph illustrates, with a series of six graphical charts and supporting tables, the flow of *replacement and consumption supplies* from the zone of interior or local procurement to consumer groups in the theater of operations.
- (2) The unit of measure, *tons per division slice*, is considered the most appropriate for long-range planning for supply of the Army and Air Force in a theater of operations. The division slice is defined (par. 4.6) as including the strength of an average division plus proportionate shares of the total corps, army, communications zone, and theater overhead units. A troop location ratio has been assumed, illustrated by the human figures shown on the first chart below. Each figure represents approximately 10,000 of the 43,250 men making up the division slice. For illustrative purposes in the following six charts, it has been assumed that

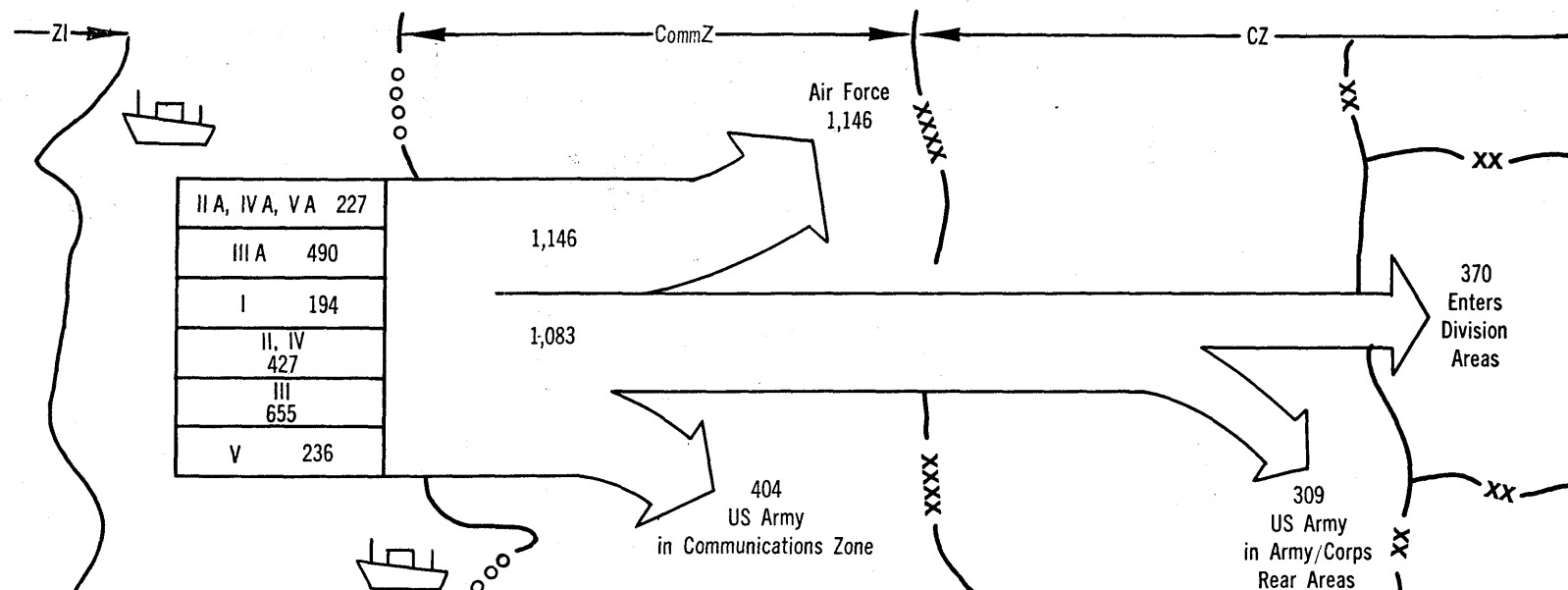
all divisions in the theater are occupying sectors along the front. In practice, varying proportions of these troops will be in reserve, in rest areas, in transit, or in staging. Also shown in a similar fashion is the proportionate air strength in the theater, based on a ratio of two wing slices (defined in par. 4.6) per division slice.

- (3) The charts include, in addition to the supplies consumed by the Army in the theater, the quantities of supplies brought into the theater for the use of the US Air Force. All are shown in terms of tons per division slice per day. In all instances, figures based on Air Force strength include those Army troops, part of the wing slice, required within the theater because of the presence of Air Force elements, which are provided Army administrative support. To separate the quantity of supplies brought into the theater for the Army from those supplies brought in for the Air Force, a horizontal dotted line has been drawn.
- (4) The flow of supplies, in terms of tons per division slice per day, shown in each of the charts is supported by *pounds per man per day* data displayed beneath each chart. These pounds per man per day figures *approximate* those found in the remainder of the chapter.
- (5) *Procurement in the theater* is indicated in each chart, except for classes V and VA, as a possible source of supply. The quantity thus available would decrease proportionately the amount to be procured from the zone of interior.
- (6) *Buildup of theater levels* is not included in this series of charts. However, it can be determined easily by a fractional increase in the amounts shown. For example, if it is desired to establish a theater reserve of 30 days of supply, and accomplish this buildup in 120 days, a fractional increase of 30/120 or one-fourth can be made in the amounts shown here.



General Consumption and Flow Chart

b. Short Tons Per Division Slice Per Day—All Classes.

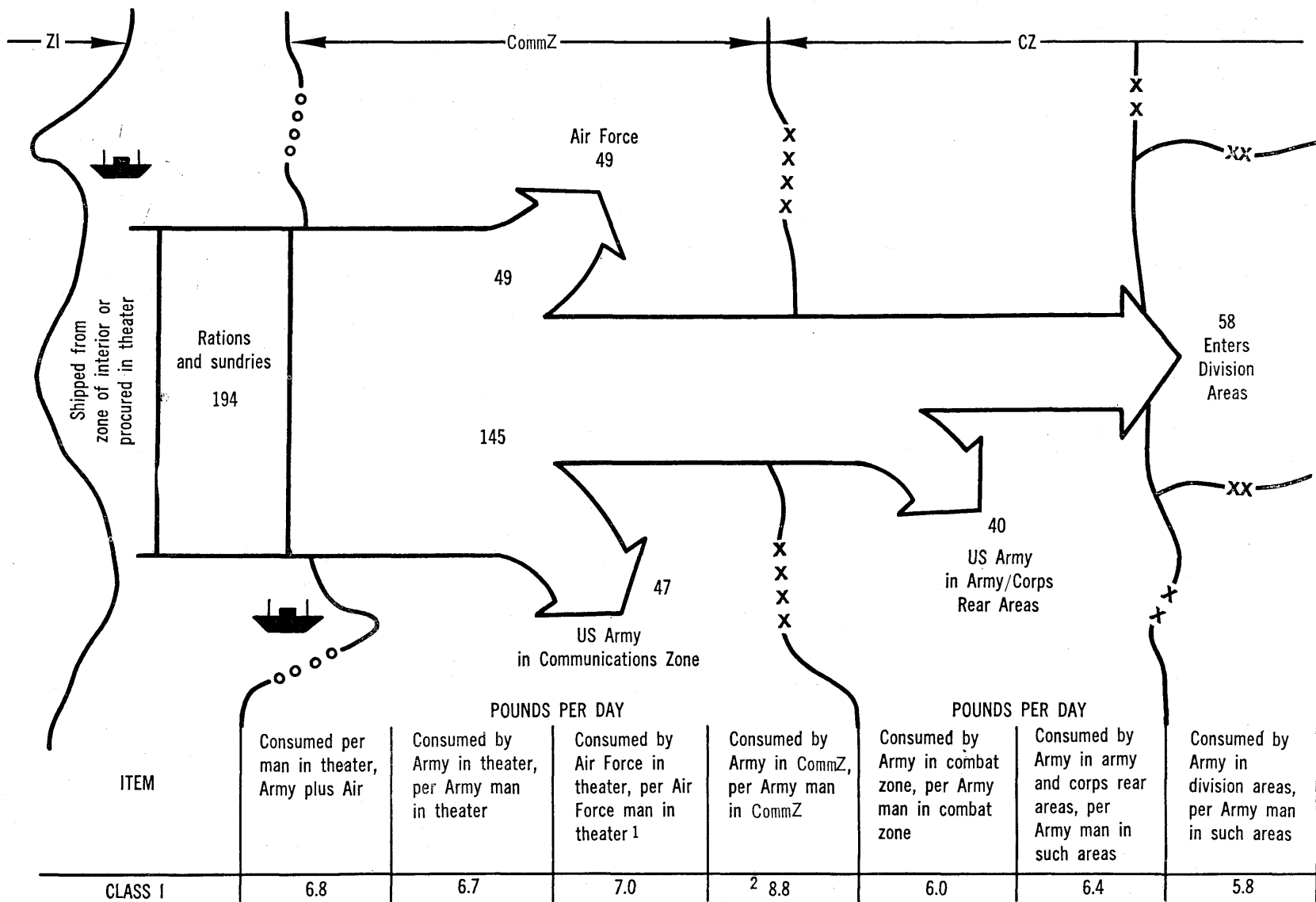


CLASS	POUNDS PER DAY				POUNDS PER DAY		
	Consumed per man in theater, Army plus Air	Consumed by Army in theater, per Army man in theater	Consumed by Air Force in theater, per Air Force man in theater 1	Consumed by Army in CommZ, per Army man in CommZ	Consumed by Army in combat zone, per Army man in combat zone	Consumed by Army in army and corps rear areas, per Army man in such areas	Consumed by Army in division areas, per Army man in such areas
I	6.8	6.7	7.0	8.8	6.0	6.4	5.8
II & IV less veh	14.28	12.13	20.88	24.5	8.03	12.6	5.2
vehicles	.65	.8	.2	.2	.98	.30	1.4
II A & IV A	3.65	.02	14.89	Negl	.03	.08	Negl
III bulk POL	13.70	11.95	19.10	19.0	9.62	17.0	5.0
pkgd & solid	9.20	8.94	10.0	22.0	4.62	12.0	Negl
III A	17.12	Negl	70.0	Negl	Negl	Negl	Negl
V	8.27	9.5	4.3	.6	12.5	1.2	19.5
VA	4.25	0	17.4	Negl	Negl	Negl	Negl
TOTAL	77.89	50.04	163.67	275.1	41.78	49.5	36.9

¹ Includes Army troops required within the theater because of the presence of Air Force elements, which are provided Army administrative support.

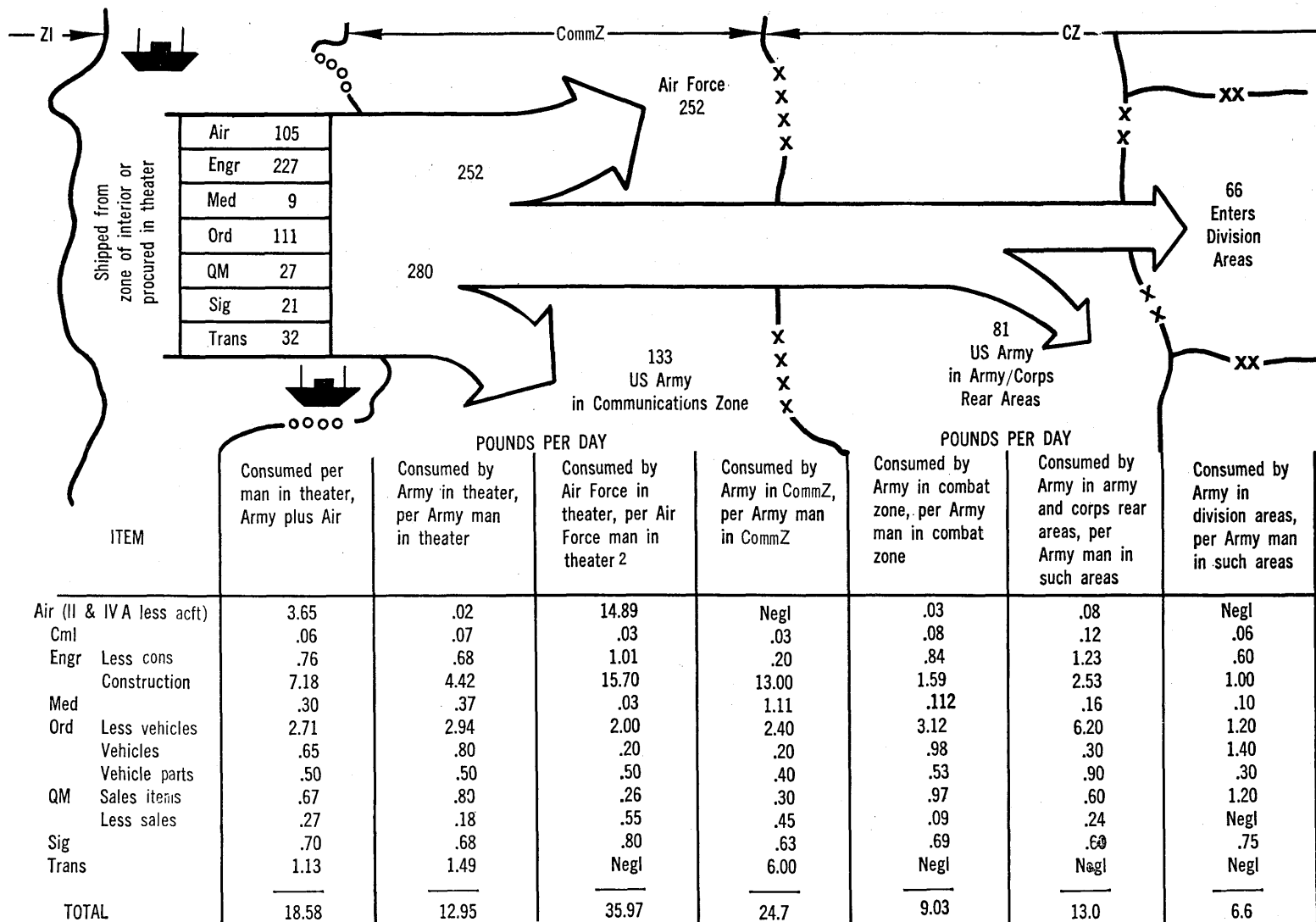
² This relatively greater figure is due to inclusion in this column of diversions to civilians, prisoners of war, and allies and miscellaneous theater-wide losses.

c. Short Tons Per Division Slice Per Day—Class I.

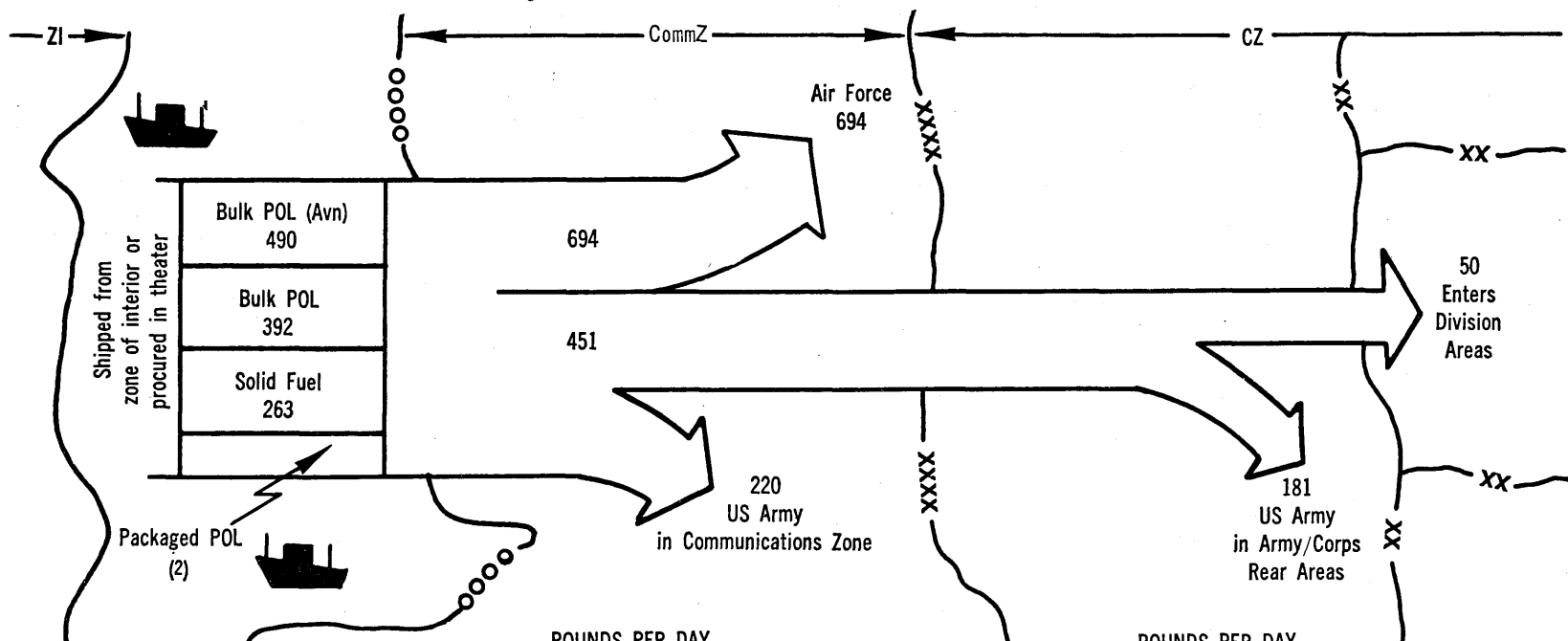


¹ Includes Army troops required within the theater because of the presence of Air Force elements, which are provided Army administrative support.

² This relatively greater figure is due to inclusion in this column of diversions to civilians, prisoners of war, and allies, and miscellaneous theater-wide losses.

d. Short Tons Per Division Slice Per Day—Classes II, IV, IIA and IVA.¹¹ Nongas conditions.² Includes Army troops required within the theater because of the presence of Air Force elements, which are provided Army administrative support.

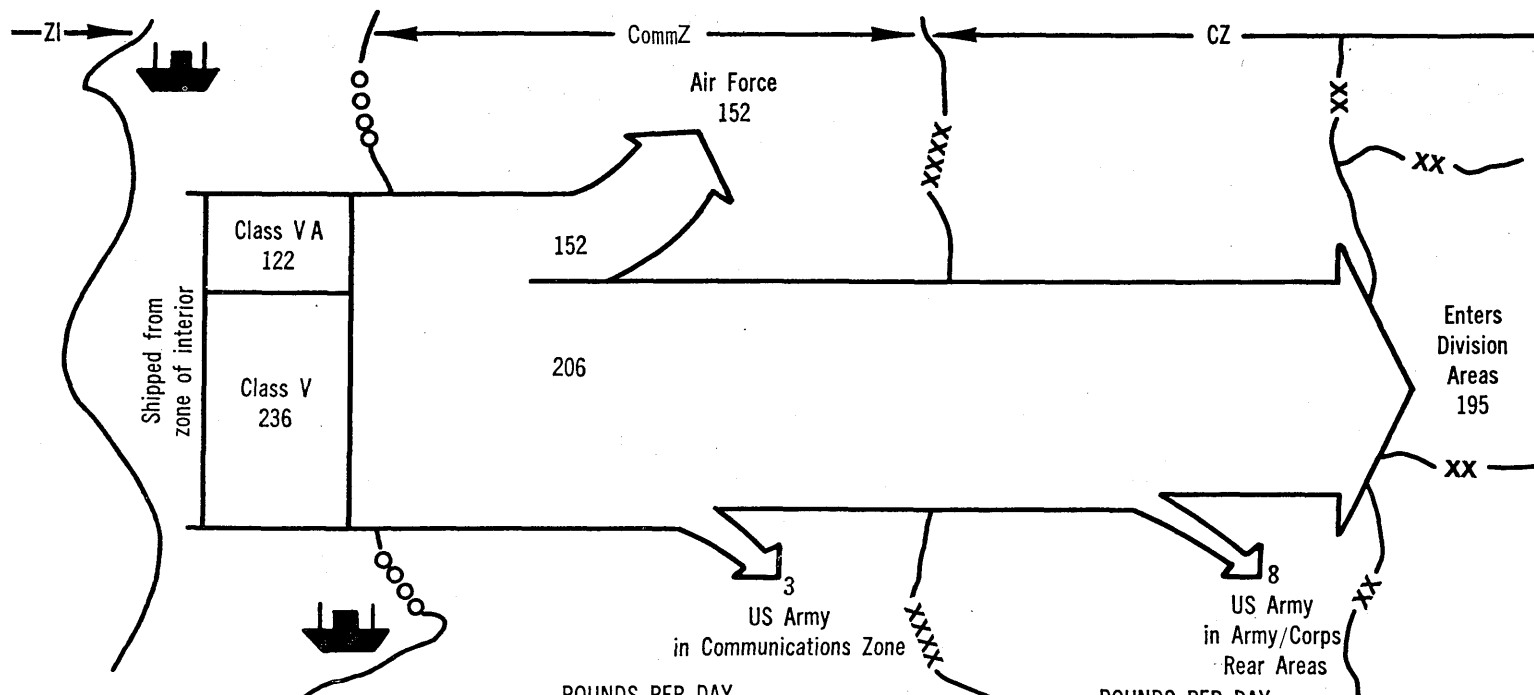
e. Short Tons Per Division Slice Per Day—Classes III and IIIA.



ITEM	POUNDS PER DAY				POUNDS PER DAY		
	Consumed per man in theater, Army plus Air	Consumed by Army in theater, per Army man in theater	Consumed by Air Force in theater, per Air Force man in theater 1	Consumed by Army in CommZ, per Army man in CommZ	Consumed by Army in combat zone, per Army man in combat zone	Consumed by Army in army and corps rear areas, per Army man in such areas	Consumed by Army in division areas, per Army man in such areas
Bulk POL (avn)	17.12	Negl	70.0	Negl	Negl	Negl	Negl
Bulk POL	13.70	11.95	19.1	2 19.0	2 9.62	2 17.0	2 5.0
Solid fuel	9.20	8.94	10.0	22.0	4.62	12.0	Negl
Packaged POL	(2)	(2)	(2)	(2)	(2)	(2)	(2)
TOTAL	40.02	20.89	99.1	41.0	14.24	29.0	5.0

¹ Includes Army troops required within the theater because of the presence of Air Force elements, which are provided Army administrative support.

² Because of the variety of means of distribution, bulk and packaged POL cannot be segregated in this table.

f. Short Tons Per Division Slice Per Day—Classes V and VA.¹

ITEM	POUNDS PER DAY				POUNDS PER DAY		
	Consumed per man in theater, Army plus Air	Consumed by Army in theater, per Army man in theater	Consumed by Air Force in theater, per Air Force man in theater 2	Consumed by Army in CommZ, per Army man in CommZ	Consumed by Army in combat zone, per Army man in combat zone	Consumed by Army in army and corps rear areas, per Army man in such areas	Consumed by Army in division areas, per Army man in such areas
Class V	8.23	9.5	4.3	.6	12.5	1.2	19.5
Class V A	4.26	0	17.4	Negl	Negl	Negl	Negl
TOTAL	12.49	9.5	21.7	.6	12.5	1.2	19.5

¹ Nongas conditions.

9 2140

² Includes Army troops required within the theater because of the presence of Air Force elements, which are provided Army administrative support.

5.48. European Theater*

	1	2	3	4	5	6
1	Item	Pounds per man per day	Tons per man per month	Conversion factor short tons to measurement tons ¹	Measurement tons per man per month	Measurement tons per man per month with 15% stowage
2	Class I-rations.....	7.170	0.108	2.1	0.227	0.261
	Class II:					
3	QM clothing and equipage.....	.426	0.006	2.0	.012	.014
4	QM general supplies.....	.305	.005	2.8	.014	.016
5	Ordnance vehicle replacement.....	.620	.009	2.2	.020	.023
6	Engineer.....	.630	.009	3.3	.030	.035
7	Ordnance.....	2.710	.041	1.8	.074	.085
8	Chemical.....	.025	.001	2.3	.002	.002
9	Signal (incl class IV).....	.725	.011	3.8	.042	.048
10	Medical (incl class IV and II).....	.300	.005	2.5	.013	.015
11	Total class II.....	5.740	.087		.207	.238
	Class III:					
	Bulk ² :					
12	Motor gasoline.....	9.100	.137	1.5	.206	.237
13	Diesel fuel.....	1.420	.021	1.5	.032	.037
14	Army aviation gasoline.....	.640	.010	1.5	.015	.017
15	Heating fuels.....	6.500	.098	1.5	.147	.169
16	Subtotal.....	17.660	.265		.398	.458
	Packaged ³ :					
17	Motor gasoline ⁴	.600	.009	1.5	.014	.016
18	Diesel fuels ⁴	.080	.001	1.5	.002	.002
19	Army aviation gasoline.....	.040	.001	1.5	.002	.002
20	Heating fuels ⁴	.430	.006	1.5	.009	.010
21	Engine oil.....	.300	.005	1.5	.008	.009
22	Gear lubricant.....	.060	.001	1.5	.002	.002
23	Greases.....	.030	Negl	1.5	Negl	Negl
24	Army aviation greases and lubricants.....	.020	Negl	1.5	Negl	Negl
25	Other.....	.150	.002	1.5	.003	.003
26	Subtotal.....	1.710	.026		.039	.045
27	Total class III.....	19.370	.291		.437	.503
	Class IV:					
28	Medical (incl in class II).....					
29	Ordnance motor maintenance.....	.510	.008	1.0	.008	.009
30	QM sales items.....	2.000	.030	1.7	.051	.059
31	AF supply and replacement.....	2.840	.043	4.0	.172	.198
32	Engineer construction material.....	7.280	.109	1.5	.164	.189
33	Signal (incl in class II).....					
34	Chemical.....	Negl				
35	Transportation.....	.14	.002	2.4	.005	.006
36	Total class IV.....	12.740	.192		.400	.461

See footnotes at end of table.

	1	2	3	4	5	6
1	Item	Pounds per man per day	Tons per man per month	Conversion factor short tons to measurement tons ¹	Measurement tons per man per month	Measurement tons per man per month with 15% stowage
	Class V:					
37	Ammunition (less AF).....	3.640	.055	.9	.050	.058
38	AF ammunition.....	4.410	.066	.9	.059	.068
39	Total class V.....	8.050	.121	-----	.109	.126
40	Total, European Theater.....	66.800	1.010	-----	1.750	2.020

* Nongas conditions.

¹ Conversion factors are based on average cubage for each item. Measurement ton (40 cu ft) of any one item can be found by multiplying its short ton (2,000 lb) weight by that item's conversion factor.

² Represents 95 percent of total theater daily consumption factor.

³ Includes weight of product and packing.

⁴ Represents 5 percent of total theater daily consumption factor.

5.49. Pacific Theater*

	1	2	3	4	5	6
1	Item	Pounds per man per day	Tons per man per month	Conversion factor short tons to measurement tons ¹	Measurement tons per man per month	Measurement tons per man per month with 15% stowage
2	Class I—rations.....	6.710	.101	2.1	.212	.244
	Class II:					
3	QM clothing and equipage.....	1.000	.015	2.0	.030	.035
4	QM general supplies.....	.730	.011	2.8	.031	.036
5	Ordnance vehicle replacement.....	.620	.009	2.2	.020	.023
6	Engineer.....	.370	.006	3.3	.020	.023
7	Ordnance.....	.300	.005	1.8	.009	.010
8	Chemical (incl class IV).....	.567	.009	2.3	.021	.024
9	Signal (incl class IV).....	.750	.011	3.8	.042	.048
10	Medical (incl class IV and II).....	.333	.005	2.5	.013	.015
11	Total class II.....	4.670	.071	-----	.186	.214
	Class III:					
	Bulk ² :					
12	Motor gasoline.....	5.000	.075	1.5	.113	.130
13	Diesel fuel.....	1.420	.021	1.5	.032	.037
14	Army aviation gasoline.....	.640	.010	1.5	.015	.017
15	Heating fuels.....	5.700	.086	1.5	.129	.148
16	Subtotal.....	12.760	.191	-----	.287	.330
	Packaged ³ :					
17	Motor gasoline ⁴	.250	.004	1.5	.006	.007
18	Diesel fuels ⁴	.080	.001	1.5	.002	.002
19	Army aviation gasoline.....	.040	.001	1.5	.002	.002
20	Heating fuels ⁴	.370	.006	1.5	.009	.010
21	Engine oil.....	.300	.005	1.5	.008	.009
22	Gear lubricant.....	.060	.001	1.5	.002	.002
23	Greases.....	.030	Negl	1.5	Negl	Negl

See footnotes at end of table.

	1	2	3	4	5	6
1	Item	Pounds per man per day	Tons per man per month	Conversion factor short tons to measurement tons ¹	Measurement tons per man per month	Measurement tons per man per month with 15% stowage
	Class III—Continued Packaged ³ —Continued					
24	Army aviation greases and lubricants.....	.030	Negl	1.5	Negl	Negl
25	Other.....	.150	.002	1.5	.003	.003
26	Subtotal.....	1.300	.020	-----	.030	.035
27	Total class III.....	14.060	.211	-----	.317	.365
	Class IV:					
28	Medical (incl in class II).....					
29	Ordnance motor maintenance.....	.180	.003	1.0	.003	.003
30	QM sales items.....	1.970	.030	1.7	.051	.059
31	AF supply and replacement.....	2.840	.043	4.0	.172	.198
32	Engineer construction material.....	11.900	.179	1.5	.268	.308
33	Signal (incl in class II).....					
34	Chemical (incl in class II).....					
35	Transportation.....	.130	.002	2.4	.005	.006
36	Total class IV.....	17.000	.257	-----	.499	.574
	Class V:					
37	Ammunition (less AF).....	5.140	.077	.9	.070	.081
38	AF ammunition.....	3.470	.052	.9	.047	.054
39	Total class V.....	8.610	.129	-----	.117	.135
40	Total, Pacific Theater.....	67.4	1.010	-----	1.760	2.030

* Nongas conditions.

¹ Conversion factors are based on average cubage for each item. Measurement ton (40 cu ft) of any one item can be found by multiplying its short ton (2,000 lb) weight by that item's conversion factor.

² Represents 95 percent of total theater daily consumption factor.

³ Includes weight of product and packing.

⁴ Represents 5 percent of total theater daily consumption factor.

5.50. Far East Theater*

Data on classes I, II and IV, and V are not available at time of publication.

	1	2	3	4	5	6
1	Item	Pounds per man per day	Tons per man per month	Conversion factor short tons to measurement tons ¹	Measurement tons per man per month	Measurement tons per man per month with 15% stowage
	Class III:					
	Bulk ² :					
2	Motor gasoline.....	8.600	.129	1.5	.194	.223
3	Diesel fuel.....	1.420	.021	1.5	.032	.037
4	Army aviation gasoline.....	.640	.010	1.5	.015	.017
5	Heating fuels.....	9.300	.140	1.5	.210	.242
	Subtotal.....	19.960	.299	-----	.449	.516

See footnotes at end of table.

	1	2	3	4	5	6
1	Item	Pounds per man per day	Tons per man per month	Conversion factor short tons to measurement tons ¹	Measurement tons per man per month	Measurement tons per man per month with 15% stowage
	Packaged ³ :					
6	Motor gasoline ⁴	.500	.008	1.5	.012	.014
7	Diesel fuels ⁴	.080	.001	1.5	.002	.002
8	Army aviation gasoline.....	.040	.001	1.5	.002	.002
9	Heating fuels ⁴	.610	.009	1.5	.014	.016
10	Engine oil.....	.400	.006	1.5	.009	.010
11	Gear lubricant.....	.100	.002	1.5	.003	.003
12	Greases.....	.040	.001	1.5	.002	.002
13	Army aviation greases and lubricants.....	.020	Negl	1.5	Negl	Negl
14	Other.....	.150	.002	1.5	.003	.003
15	Subtotal.....	1.940	.029	-----	.044	.051
16	Total class III.....	21.900	.329	-----	.494	.568

* Nongas conditions.

¹ Conversion factors are based on average cubage for each item. Measurement ton (cu ft) of any one item can be found by multiplying its short ton (2,000 lb) weight by that item's conversion factor.

² Represents 95 percent of total theater daily consumption factor.

³ Includes weight of product and packing.

⁴ Represents 5 percent of total theater daily consumption factor.

5.51. Polar Regions*

	1	2	3	4	5	6
1	Item	Pounds per man per day	Tons per man per month	Conversion factor short tons to measurement tons ¹	Measurement tons per man per month	Measurement tons per man per month with 15% stowage
2	Class I—rations.....	10.40	.156	2.1	.328	.377
	Class II:					
3	QM clothing and equipage.....	.85	.013	2.9	.038	.044
4	QM general supplies.....	.40	.006	2.8	.017	.020
5	Ordnance vehicle replacement.....	.62	.009	2.2	.020	.023
6	Engineer.....	.84	.013	3.3	.043	.049
7	Ordnance.....	2.00	.030	1.8	.054	.062
8	Chemical (incl class IV).....	.03	Negl	2.3	.001	.001
9	Signal (incl class IV).....	.66	.010	3.8	.038	.044
10	Medical (incl class IV).....	.40	.006	2.5	.015	.017
11	Total class II.....	5.8	.087	-----	.226	.260
	Class III:					
	Bulk ² :					
12	Motor gasoline.....	10.890	.163	1.5	.245	.282
13	Diesel fuel.....	1.420	.021	1.5	.032	.037
14	Army aviation gasoline.....	.640	.010	1.5	.015	.017
15	Heating fuels.....	17.100	.257	1.5	.386	.444
16	Subtotal.....	30.050	.451	-----	.677	.779

See footnotes at end of table.

	1	2	3	4	5	6
1	Item	Pounds per man per day	Tons per man per month	Conversion factor short tons to measurement tons ¹	Measurement tons per man per month	Measurement tons per man per month with 15% stowage
	Packaged ³ :					
17	Motor gasoline ⁴	.710	.011	1.5	.017	.020
18	Diesel fuels ⁴	.080	.001	1.5	.002	.002
19	Army aviation gasoline.....	.040	.001	1.5	.002	.002
20	Heating fuels ⁴	.900	.014	1.5	.021	.024
21	Engine oil.....	.800	.012	1.5	.018	.021
22	Gear lubricant.....	.200	.003	1.5	.005	.006
23	Greases.....	.050	.001	1.5	.002	.002
24	Army aviation greases and lubricants.....	.020	Negl	1.5	Negl	Negl
25	Other.....	.150	.002	1.5	.003	.003
26	Subtotal.....	2.950	.044	-----	.066	.076
27	Total class III.....	33.000	.495	-----	.743	.854
	Class IV:					
28	Medical (incl in class II).....					
29	Ordnance motor maintenance.....	.5	.008	1.0	.008	.009
30	QM sales items.....	2.0	.030	1.7	.051	.059
31	AF supply and replacement ⁵	3.5	.052	4.0	.208	.239
32	Engineer construction material.....	12.0	.180	1.5	.270	.310
33	Signal (incl in class II).....					
34	Chemical (incl in class II).....					
35	Transportation.....	.14	.002	2.4	.005	.006
36	Total class IV.....	18.14	.272	-----	.542	.624
	Class V:					
37	Ammunition.....	1.8	.027	0.9	.024	.028
38	AF ammunition ⁶	3.5	.052	0.9	.047	.054
39	Total class V.....	5.3	.079	-----	.071	.082
40	Total.....	81.14	1.22	-----	2.24	2.58

* Estimated, based on Arctic test operations.

¹ Conversion factors are based on average cubage for each item. Measurement tons (40 cu ft) of any one item can be found by multiplying its short ton (2,000 lb) weight by that item's conversion factor.

² Represents 95 percent of total theater daily consumption factor.

³ Includes weight of product and packing.

⁴ Represents 5 percent of total theater daily consumption factor.

⁵ Classes IIA and IVA.

⁶ Class VA.

5.52. Combat Zone and Communications Zone

	1	2	3	4
	Pounds per man per day			
	Item	Per Army man in combat zone continental land mass ¹	Per Army man in combat zone, jungle ²	Per Army man in communications zone ³
1				
2	Class I.....	7.69	5.95	8.80
3	Classes II and IV:			
4	Air.....	.023	.016	Negligible
5	Cml.....	.040	.090	.030
6	Engr.....	2.49	8.95	13.2
7	Med.....	.112	.560	1.11
8	Ord.....	4.95	.860	3.00
9	QM.....	.928	1.35	.75
10	Sig.....	.973	.346	.63
11	Trans.....	.11	Negligible	6.00
12	Total II and IV.....	9.63	12.2	24.7
13	Class III.....	12.0	7.53	41.0
14	Class V.....	13.4	8.68	1.40
15	Total.....	43.2	34.4	75.9

¹ Based on operations in Europe, all armies, 24 February 1945 to 28 March 1945.

² Based on Sixth and Eighth Army operations, December 1943 to September 1944.

³ Assumed from theater averages, World War II.

5.53. Field Army and Corps in Combat (Continental Land Mass)

	1	2	3
	Short tons per day		
	Item	Per field army ¹	Per corps ²
1			
2	Class I.....	1,508	356
3	Classes II and IV:		
4	Air.....	4.5	1.6
5	Cml.....	7.8	1.8
6	Engr.....	488	115.
7	Med.....	21.9	5.2
8	Ord.....	970	229.0
9	QM.....	181	42.9
10	Sig.....	191	45.
11	Trans.....	21.6	5.
12	Total II and IV.....	1,886	445.
13	Class III.....	2,350	555.
14	Class V ³	2,630	620
15	Total.....	8,374	1,975

¹ Computed for field army of 3 corps, each corps composed of 3 infantry divisions and 1 armored division, and including necessary supporting and service elements (total strength 392,000).

² Computed for corps of 3 infantry divisions and 1 armored division, with necessary supporting and service elements. (Total strength 92,500.)

³ Class V data applicable for periods of 14 days or more.

5.54. Airborne Division (ROTAD—Strength 11,500) in Airborne Assault¹

	1	2	3
	Item	Pounds per man per day	Short tons per division per day
2	Class I	6.60	39
	Classes II and IV:		
3	Cml.....	0.0	6.0
4	Engr.....	1.00	6.0
5	Med.....	.42	2.0
6	Ord.....	1.50	9.0
7	QM.....	1.00	6.0
8	Sig.....	1.04	6
9	Trans (avn) ²		
10	Total II and IV	4.96	29.0
11	Class III and IIIA ³	12.49	73.0
	Class V ⁴ :		
12	Cml.....	.20	1.2
13	Ord.....	67	391.
14	Total V	67.2	392
15	Total	91.25	533

¹ Nongas conditions—based on World War II data, modified to reflect new organization and strength. Changed tactical concepts may further modify these data.

² Experience factors not available.

³ 5,000-gal per day for vehicles in objective area; average 6 hr per day flying time per organic aircraft in objective area.

⁴ Computed as one-half basic load.

5.55. Armored Division¹ (ROCAD—Strength 14,600)

	1	2	3	4	5	6	7	8	9
	Item	Attack		Pursuit and exploitation		Defense		Reserve	
		Pounds per man per day	Short tons per division per day	Pounds per man per day	Short tons per division per day	Pounds per man per day	Short tons per division per day	Pounds per man per day	Short tons per division per day
2	Class I.....	5.37	39	5.61	41	5.51	40	5.51	40
3	Classes II and IV:								
4	Cml.....	.25	1.8	.25	1.8	.25	1.8	.25	1.8
5	Engr.....	.70	5.1	.54	3.9	.42	3.1	.21	1.8
6	Med.....	.30	2.2	.30	2.2	.15	1.1	.15	1.1
7	Ord.....	² 14.10	103	2.14	15.6	2.00	14.6	³ 2.50	18.3
8	QM.....	2.11	15.4	2.11	15.4	2.11	15.4	³ 2.25	16.4
9	Sig.....	0.87	6.4	.85	6.2	.37	2.7	.37	2.7
10	Trans.....	.12	.88	.12	.88	.12	.88	.12	.88
11	Total II and IV.....	18.42	135	6.31	46	5.42	39	5.85	43
12	Class III.....	13.80	101	23.30	170	7.51	55	5.83	43
13	Class V.....	50.0	365	8.8	64	53.2	387	(4)	-----
14	Total.....	87.6	641	44.0	421	71.6	521	17.4	127

¹ Nongas conditions—based on World War II data, modified to reflect new organizations and strengths. Changed tactical concepts may further modify these data.

² Primarily battle losses of combat vehicles.

³ Increase over inactive situation because of intensified maintenance and replacement activities.

⁴ All elements of division out of combat.

5.56. Infantry Division (ROCID—Strength 13,750)

a. Offensive Operations.¹

	1	2	3	4	5	6	7	8	9	10	11
	Item	Attack of fortified position		Attack of deliberately organized position		Attack of hastily organized position		Pursuit		Assault of hostile shore	
		Pounds per man per day	Short tons per division per day	Pounds per man per day	Short tons per division per day	Pounds per man per day	Short tons per division per day	Pounds per man per day	Short tons per division per day	Pounds per man per day	Short tons per division per day
2	Class I.....	5.72	39	5.37	37	5.46	38	5.61	39	6.19	43
3	Classes II and IV:										
4	Cml.....	.251	1.7	.252	1.7	.051	.4	.091	.6	.191	1.3
5	Engr.....	2.13	14.6	.843	5.8	1.26	8.7	.979	6.7	1.17	7.8
6	Med.....	.301	2.1	.301	2.6	.125	.9	.111	.8	.221	1.5
7	Ord.....	1.67	11.5	1.67	11.5	2.83	19.5	2.08	14.3	.769	5.3
8	QM.....	.942	6.5	.929	6.4	.938	6.6	.659	4.5	.502	3.5
9	Sig.....	.959	6.6	.991	6.8	.961	6.6	.710	4.8	.389	2.7
10	Trans.....	.11	.96	.11	.96	.11	.96	.11	.96	.11	.96
11	Total II and IV.....	6.36	44	5.09	35	6.27	44	4.74	33	3.35	23
12	Class III.....	4.93	34	7.92	54	8.47	58	15.3	106	4.56	32
13	Class V.....	47.8	329	44.4	305	42.8	294	7.7	53	43.3	298
14	Total.....	64.8	446	62.8	431	63.0	434	33.3	231	57.4	396

¹ Nongas warfare—based on World War II data, modified to reflect new organizations and strengths. Changed tactical concepts may further modify these data.

*b. Defensive Operations.*¹

	1	2		3		4		5	
1	Item	Covering, security force, retirement, or delaying action		Defense of position		Inactive situation		Reserve	
		Pounds per man per day	Short tons per division per day	Pounds per man per day	Short tons per division per day	Pounds per man per day	Short tons per division per day	Pounds per man per day	Short tons per division per day
2	Class I.....	5.42	37	5.51	38	5.19	36	5.38	37
3	Classes II and IV:								
4	Cml.....	.361	2.5	.361	2.5	.251	1.7	.251	1.7
5	Engr.....	.811	5.6	1.46	10.3	.501	3.4	.159	1.1
6	Med.....	.121	.8	.221	1.5	.151	1	.151	1.0
7	Ord.....	1.47	10.1	1.50	10.3	.829	5.7	1.25	8.6
8	QM.....	1.32	9.1	1.10	7.6	2.11	14.5	2.11	13.1
9	Sig.....	.721	5.0	.989	6.6	.479	3.3	.479	3.3
10	Total II and IV...	4.80	33	5.63	39.	4.32	29	4.40	30
11	Class III.....	12.5	86	6.83	47	6.41	44	2.23	15
12	Class V.....	26.1	179	50.0	344	16.2	111	-----	-----
13	Total.....	48.8	335	67.9	470	32.1	220	12.0	82

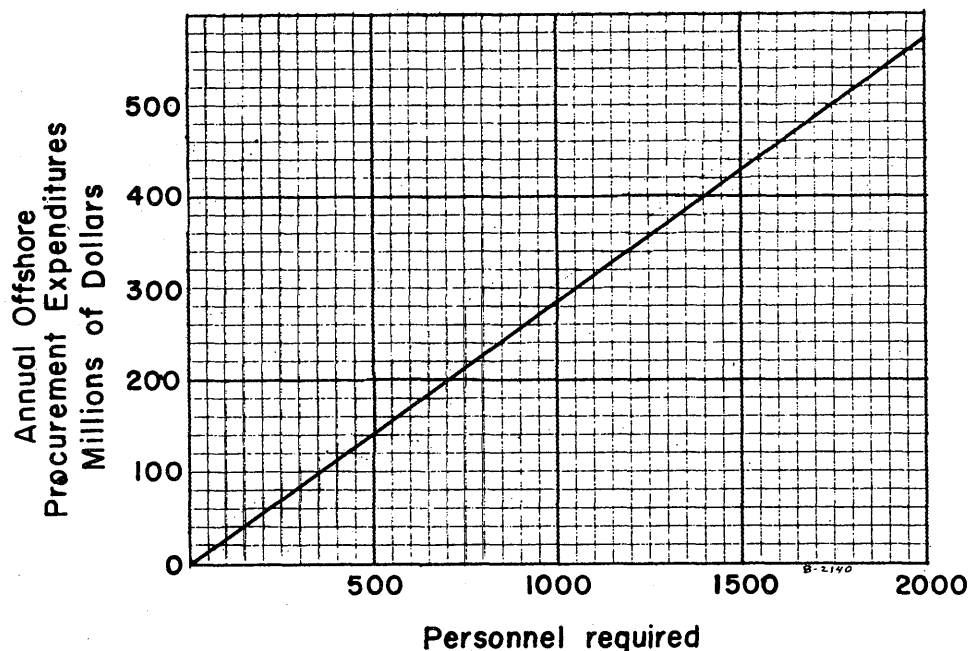
¹ Nongas warfare—based on World War II data, modified to reflect new organizations and strengths. Changed tactical concepts may further modify these data.

Section VIII. PROCUREMENT

5.57. Procurement

a. Procurement Operations. Subsequent to World War II, the US Army has been called upon to provide logistical support for Allied forces throughout the world in addition to fulfilling its own requirements. "Offshore" procurement agencies have been established in

Europe, the Middle East, and the Far East to supplement supplies which must be obtained from the zone of interior. Officers assigned to MAAG type units may estimate the personnel required in a procurement section for the supplementary support of Allied forces by use of the following chart, which is applicable to all type supplies:



b. Procurement Lead Time. Procurement lead time may vary from 2 to 24 months. Because of the many variables involved, it is not possible to obtain an average estimate of lead time with any degree of accuracy. Some of the factors affecting lead time are type of item,

quantity to be procured, status of production base, and tooling involved. The appropriate technical service should be consulted on an item-by-item basis when a close estimate of lead time is required.

Section IX. STORAGE

5.58. Definition of Terms

An understanding of the following terms is necessary in order to be able to use the data listed in this section in determining storage area requirements.

a. Storage Space—Any space, without regard to type of construction or improvement, used for storage.

b. Storage Building—Any building constructed or acquired for the storage of supplies, even though some part of it has been diverted to and is used for office, depot utility storage, or repair shops. Buildings constructed or acquired for office buildings, repair shops, depot utility storage buildings, except when they are used in whole or in part for the storage of supplies, are not considered storage buildings. The actual area used for storage purposes within such a building is considered storage space for reporting purposes.

- (1) *Warehouse space*—Area in a building designed for storage purposes and

constructed with roof and complete side and end walls.

- (2) *Heated space*—Area in which the temperature may be controlled within specified limits by the application of heat.
- (3) *Unheated space*—Area not equipped with heating facilities.
- (4) *Humidity controlled space*—Warehouse area equipped with humidity control equipment.
- (5) *Flammable space*—Warehouse area which has been designed for the storage of highly flammable material.
- (6) *Shed space*—Area in a building without complete side and end walls.
- (7) *Other space*—Any area assigned for storage operations, within a structure designed for other than storage purposes. Dry tank space is included.

c. Gross Space—The entire inside area of covered storage space, determined by using in-

side dimensions of building; the overall area of open storage space with no deductions for trackage and permanent roads; the actual storage space (pads) for open ammunition or toxic space.

d. Bin Storage—Storage of parts, subassemblies, assemblies, or end items in bins so that an item may be withdrawn without breaking open a package containing a number of such items.

e. Aisle in Storage Space—Area designated for passageway within the storage area.

f. Receiving and Shipping Space—Gross space designated as work area for receipt and shipment of supplies and equipment.

g. Nonstorage Space—That area within gross space which is not used for storage because of structural losses or designation for other than storage purposes. Includes transit shed space when used or reserved for that purpose.

h. Net Storage Space—The floor area upon which bins are erected plus the floor areas upon which material can be stored.

i. Net Usable General Storage Space—That portion of total gross space on which supplies can actually be stored. It does not include bin storage space, aisles, or receiving and shipping space.

j. Open Space—Improved or unimproved area designated for use in storing material.

k. Open Improved Storage Space—Open area which has been graded and hard surfaced or prepared with topping of some suitable material so as to permit effective material handling operations.

l. Open Unimproved Wet Space—That water area specifically allotted to and usable for the storage of floating equipment.

m. Magazine (Including "Igloo")—Storage structures above or below ground, constructed for the storage of ammunition and explosives. These structures will be reported as magazines regardless of whether ammunition and explosives are actually stored in them. The only circumstances under which magazines will be reported under warehouse space is when the magazine has been designated as "flammable material space" in accordance with definition heretofore. Conversely, warehouses containing ammunition will not be reported as magazines. Occupancy of magazine will be computed to include that area utilized as access aisle space

continuous to materials stored. The remainder unoccupied will be reported as vacant.

n. Tank Storage Space—Space in tank designated for the storage of supplies other than bulk liquids.

o. Ammunition and Toxics Open Space—Area especially prepared for storage of explosive ammunition and toxic materiel. For reporting purposes, it does not include the surrounding area restricted for storage because of safety distance factors. It includes barricades and improvised coverings.

p. Cold Storage Warehouse—Space in which a controlled temperature below 50° may be maintained.

(1) *Chill space*—Refrigerated warehouse area in which the temperature can be controlled between 32° F. and 50° F.

(2) *Freeze space*—Refrigerated warehouse area in which the temperature can be controlled below a level of 32° F.

q. Allocated Space—That area designated by higher authority representing the gross area formally apportioned for use. Space formally apportioned to the heads of administrative and technical services by the Deputy Chief of Staff for Logistics, Department of the Army.

r. Dispersed Storage Areas—Those portions of a depot or subinstallation that are geographically located away from the main establishment, but not at another reporting installation.

s. Subinstallations—Those establishments so designated by Department of the Army directives.

t. Site Area—

(1) Site area, in covered storage, is the total land area required for buildings, spaced at minimum distances, plus all the necessary operating areas such as access roads, depot roads, railway sidings, and truck parks.

(2) Site area, in open storage, is the total land surface required for net usable general storage area as defined above, plus that additional area required to fulfill safety regulations and to properly operate the storage facility as a whole.

u. Gross Space Factor—The gross space factor is the ratio of the gross space to the net usable general storage area. After the net

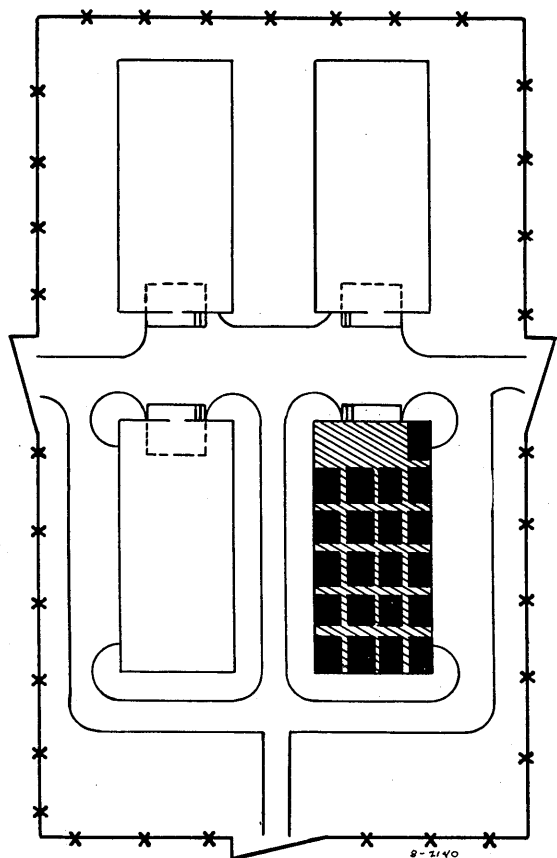
usable general storage area requirement, as described above, has been determined, the gross space requirement is obtained by multiplying the net usable general storage area value by the pertinent gross space factor, as follows:

Net usable general storage area $\times$ gross space factor = gross space.

v. *Site Area Factor*—The site area factor is a

ratio of the site area to gross space. These figures can be determined by the use of gross space and site area factors shown on chart, paragraph 5.62. Having determined the gross space requirements, the site area requirement is obtained by multiplying the gross space value by the pertinent site area factor as follows: gross space $\times$ site area factor = site area.

w. *Illustrating Diagram*—



LEGEND

■ = Net usable storage area.

■ + ▨ = Gross space (in covered storage, this equals the total floor space of the buildings).

■ + ▨ + [x] = Site area.

(in covered storage, this equals the total floor space of the

5.59. Storage Factors

a. The following table gives optimum storage tonnage area requirements for support of mili-

tary operations. These data are for general planning purposes only and may vary greatly as a result of climate conditions or the tactical situation.

	1	2	3	4	5	6	7	8
	Class	Consumed per man in theater, Army plus AF, short tons/man/month	Percentage of tons of supplies stored		Tons/man/month of supplies stored		Gross space/man/month of supply	
			Covered	Open	Covered (short tons)	Open (short tons)	Covered (sq ft)	Open (sq ft)
1								
2	I.....	0.1005	60	40	0.0603	.0402	0.910	0.803
3	II, IV, IIA and IVA: Air (IIA and IVA less aircraft).....	.0390	(Storage provided in air depot)					
4	Chemical.....	.0009	70	30	0.0006	0.0003	.011	.009
	Engineer:							
5	Less construction.....	.0095	20	80	.0019	.0076	.023	.152
6	Construction.....	.1092	10	90	.0109	.0983	.125	1.875
7	Medical.....	.0045	90	10	.0040	.0005	.080	.012
	Ordnance:							
8	Less vehicles.....	.0407	20	80	.0081	.0326	.120	.644
9	Vehicles.....	.0102	0	100	.0000	.0102	.000	.276
10	Vehicle parts.....	.0077	40	60	.0031	.0046	.048	.124
	Quartermaster:							
11	Sales items.....	.0110	90	10	.0099	.011	.133	.030
12	Less sales.....	.0041	90	10	.0037	.0004	.050	.011
13	Signal.....	.0110	70	30	.0077	.0033	.210	.045
14	Transportation.....	.0020	5	95	.0001	.0019	.001	.034
	III and IIIA:							
15	Bulk POL (avn).....	.1380	(Tank Farm)					
16	Bulk POL.....	.1455	(Tank Farm)					
17	Solid fuel.....	.1320	0	100	.0000	.1320	.000	2.640
18	Packaged POL.....	.0135	10	90	.0014	.0121	.021	.327
	V and VA:							
19	V (including 10% of VA) ¹	.1304	10	90	.0130	.1174	.195	2.350
20	VA.....	.0527	(Storage provided in air depot)					
21	Totals.....	.9624			0.1203	0.4669	1.762	9.763
22	Cl, II, III (pkgd), and IV.....	.3248	33	67	.1073	.4669	1.567	4.763
23	Cl III solid fuels.....	.1320	0	100	.0000	.1320	.000	2.640
24	Cl V.....	.1304	10	90	.0130	.1174	.195	2.350

¹Army supporting Air Force will store small arms ammunition which is estimated to be 10 percent of total.

b. Average ratios of gross space open to covered, by classes of supply are as follows:

	Ratios of gross space open to covered	
All classes (except bulk POL).....	5.5	1
Classes I, II, III (pkgd and solid), and IV.....	4.7	1
Classes I, II, III (pkgd), and IV.....	3	1
Class V (including 10 percent of VA).....	12	1

5.60. Storage Space Conversion Factors

The following table indicates the net usable general storage area (sq ft) occupied per short ton:

	1	2	3	4	5
	Branch	Type of storage			
		Covered storage	Open storage	Igloo and magazine	Open storage ammunition
1					
2	Ordnance Corps.....	10.0	18.0	7.0	11.0
3	Signal Corps.....	10.0	16.0		
4	Corps of Engineers.....	8.0	13.0		
5	Chemical Corps.....	12.5	20.8	7.0	11.0
6	Army Medical Service.....	13.0	16.0		
7	Quartermaster Corps.....	9.0	17.1		
8	Transportation Corps.....	7.0	12.0		
9	Adjutant General's Corps.....	10.0			

5.61. Average Stack Heights*

- a. *Covered Storage.* All services-----8 ft
b. *Open Storage.* All services-----6 ft.

5.62. Gross Space and Site Area Factors

	1	2	3	4	5	6
	Class of supply	Services	Gross space factors ¹		Site area factors ²	
			Covered	Open	Covered	Open
1	I-----	Quartermaster--	1.40	1.50	2.00	1.50
3	II-----	All services-----	1.25	1.30	1.80	1.43
4		Ordnance-----	2.00	2.00	3.00	3.00
5		Quartermaster--	1.40	1.50	2.00	1.50
6		Signal-----	2.00	2.20	1.80	1.43
7	III ³ ---	Quartermaster--	1.25	1.30	1.80	1.43
8	IV-----	All services-----	1.25	1.30	1.80	1.43
9		Ordnance-----	2.00	2.00	3.00	3.00
10		Quartermaster--	1.40	1.50	2.00	1.50
11		Signal-----	2.00	2.20	-----	-----
12	V-----	Ordnance and chemical.	1.25	1.25	412.00	(⁵)

¹ Apply additional factor of 3 for storage in combat zone.

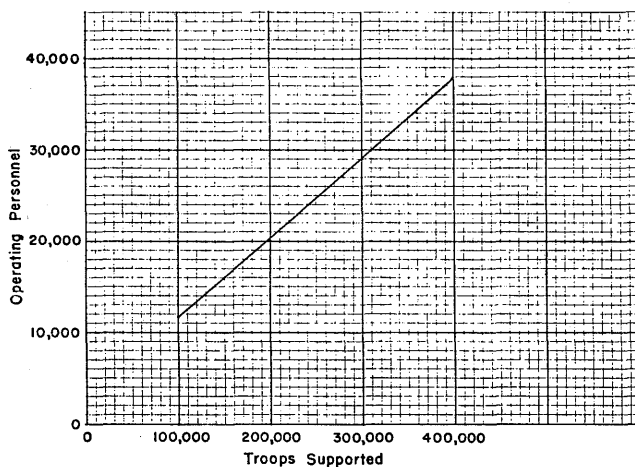
² Apply additional factor of 5 for storage of classes I, II, III, and IV in the combat zone.

³ Excludes bulk storage of petroleum in tanks.

⁴ These factors take into consideration the great amount of dispersion necessary as a safety precaution in storing ammunition.

⁵ See paragraph 5.64.

5.63. Operating Personnel Required for All Storage Within a Theater**



* Figures given are for use in theaters. For zone of interior storage, increase by 25 percent.

** May include prisoners of war and civilians as available.

5.64. Miscellaneous Factors¹

- Ammunition storage per mile of road²-----1,000 short tons.
Ammunition storage per square mile²-----5,000 short tons.
Minimum hardstanding requirements for 2,500 vehicles³-----110,000 sq ft.
Solid footing for vehicle park for 2,500 vehicles-----4,000,000 sq ft.
Minimum hardstanding requirement for artillery and combat vehicles, per item-----350 sq ft.

¹ Reference: ORD M 7-224.

² Refers to temporary storage of ammunition along roadways and in urban fields and forest, such as may be found in combat zones.

³ Data based on the assumption that hardstanding area will not be required for the total number of vehicles at any one time.

5.65. Handling of Supplies

a. Labor Requirements.

(1) *Hand operations.* For long-term planning purposes, labor requirements for handling supplies by hand are computed on the average of one-half ton per man per hour for 10 hours each day. For short periods, the average is much higher.

(2) *Mechanical handling.* For planning purposes, the labor requirements for handling supplies by use of mechanical equipment, such as forklift trucks and tractor-trailer trains, are normally limited to a working foreman and equipment operators to operate the mechanical equipment necessary to efficiently handle these supplies.

b. Handling Crews.

(1) *Hand operations.* The maximum number of men that may be employed advantageously in loading or unloading 1 freight car is 9 (1 working foreman and 8 laborers). The maximum crew for loading or unloading average loads by hand on Army trucks is 5 men (1 working foreman and 4 laborers).

(2) *Mechanical handling of palletized loads.* The maximum number of men required to advantageously load or unload 1 freight car or truck of palletized supplies using mechanical handling equipment is 3 (1 working foreman and 2 materials handling equipment operators).

c. *Time Estimate* (based on manual handling).

- (1) The time estimate for average packaged or bundled military loads⁴ at depots, supply points, or using units, under average conditions, a 5-man crew for each truck or trailer, and the number of trucks or trailers to be loaded or unloaded simultaneously, dependent upon amount of labor available, is as follows:

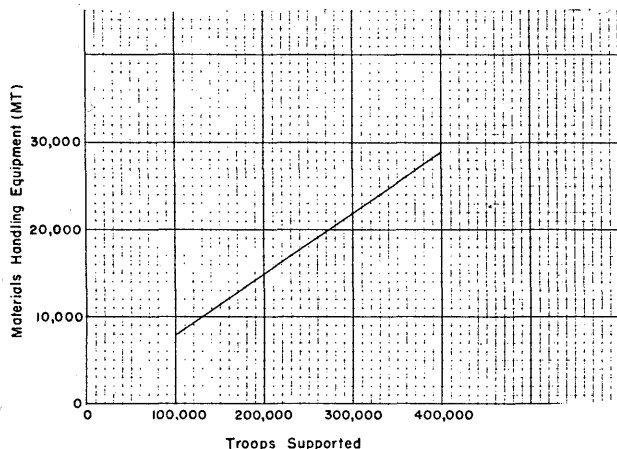
<i>Loading and unloading</i>	<i>2½-ton truck</i>	<i>1½-ton trailer</i>
Average time-----	50 min.	20 min.
Minimum time-----	30 min.	12 min.

- (2) For prescribed loads, under field conditions, when the amount of labor available is limited:

	<i>Day</i>	<i>Night</i>
Unloading -----	15 min.	30 min.
Loading -----	30 min.	60 min.

5.66. Materials Handling Equipment Requirements

A depot supplying 100,000 men will require approximately 7,700 measurement tons of materials handling equipment, including conveyors, pallets, scales, tractors, trailers, forklift trucks, handtrucks, lumber-straddle trucks, stock-picker trucks, etc.



5.67. Illustrative Problems

a. *Situation, Problem A.* To determine storage requirements for a theater of operations requiring 100,000 measurement tons of class I supplies.

b. *Solution, Problem A.* Storage area requirements:

A measurement ton (MT) = 40 cu ft.

Therefore, $100,000 \text{ MT} \times 40 = 4,000,000$ cu ft of supplies to be stored.

Minimum percentage of covered storage required is 60 percent (see par. 5.59).

Therefore, 40 percent open storage required.

$.60 \times 4,000,000 \text{ cu ft} = 2,400,000 \text{ cu ft}$ of supplies requiring covered storage.

$.40 \times 4,000,000 \text{ cu ft} = 1,600,000 \text{ cu ft}$ of supplies to be stored in the open.

Average stack heights (see par. 5.60):

Covered storage = 8 feet.

Open storage = 6 feet.

$2,400,000 \text{ cu ft} \div 8 \text{ ft} = 300,000 \text{ sq ft, net}$ usable area of covered storage required.

$1,600,000 \text{ cu ft} \div 6 \text{ ft} = 267,000 \text{ sq ft, net}$ usable area of open storage required.

Gross space for each type of storage are based on net usable general storage areas. Factors for computations, as found in paragraph 5.62, are—

Covered storage = 1.40

Open storage = 1.50

(Assume storage is to be in communications zone; hence, additional combat zone factor of 3 is not required.)

$300,000 \text{ sq ft} \times 1.40 = 420,000 \text{ sq ft, gross}$ space required for covered storage.

$267,000 \text{ sq ft} \times 1.50 = 400,500 \text{ sq ft, gross}$ space required for open storage.

Site areas for each type of storage are based on gross space. Factors for computations are found in paragraph 5.62.

Covered storage = 2.00

Open storage = 1.50

(Assume storage is to be in communications zone; hence, additional combat zone factor of 5 is not required.)

$420,000 \text{ sq ft} \times 2.00 = 840,000 \text{ sq ft, site}$ area required for covered storage.

$400,500 \text{ sq ft} \times 1.50 = 600,750 \text{ sq ft, site}$ area required for open storage.

⁴ See chapter 7 regarding authorized 100 percent overload for certain vehicles under some conditions and double time estimates when necessary.

Total site area required:

Covered storage = 840,000 sq ft

Open storage = 600,750 sq ft

1,440,750 sq ft

1,440,750 sq ft ÷ 43,560 sq ft (1 acre) is
30.7 or 31 acres of site area required.

c. *Situation, Problem B.* To determine operating personnel and materials handling equipment requirements for all storage in a theater which has a strength of 250,000 men.

d. *Solution, Problem B.*

- (1) *Part I, operating personnel requirements.* (See graph, par. 5.63.) On the horizontal scale of this graph, lo-

cate the vertical line representing 250,000 men. This line crosses the oblique graph line at the horizontal line representing 24,500 operating personnel as indicated on the left margin. Therefore, for general planning purposes, 24,500 men are needed to operate theater depots.

- (2) *Part II, materials handling equipment requirements.* Using the same assumption for theater strength as used in part I above, the graph in paragraph 5.66 shows that for 250,000 men, 18,500 measurement tons of materials handling equipment will be required.

5.68. Characteristics of Materials Handling Equipment

	1	2	3	4	5	6	7	8	9	10	11	12	
1	Item ¹	Dimensions			Weight (lb)		Displacement (cu ft)	Capacity		Type of tires ²	Method of operation	Primary use	
		Length (in)	Width (in)	Height (in) minimum	Operating	Shipping		Load (lb)	Height (ft)	S-solid rubber P-pneumatic			
2	Trucks, forklift---	69	35	83	4,480	-----	119	2,000	10' 10"	S	Gasoline	Useful in moving and stacking palletized loads. Not efficient to move supplies over horizontal distances greater than 250 ft.	
3	-----	65	35	83	3,700	-----	166	2,000	10' 10"	S	Electric		
4	-----	76	41	83	5,876	-----	150	3,000	9	S	Gasoline		
5	-----	115	79	107	7,035	-----	570	3,500	12	P	Gasoline		
6	-----	78	41	91	6,870	7,130	174	4,000	12	S	Gasoline		
7	-----	76	41	102	6,186	-----	184	4,000	12	S	Gasoline		
8	-----	105	45	95	7,660	-----	260	4,000	12	P	Gasoline		
9	-----	118	33	83	5,714	6,470	153	4,000	10' 10"	S	Electric		
10	-----	77	41	91	5,920	6,300	146	4,000	12	S	Electric		
11	-----	113	68	115	10,375	10,800	528	6,000	14	P	Gasoline		
12	-----	94	42	92	9,200	-----	210	6,000	10' 7"	S	Gasoline		
13	-----	94	42	113	9,400	-----	258	6,000	14	S	Gasoline		
14	-----	84	43	102	10,155	-----	212	6,000	14	S	Electric		
15	-----	136	77	150	14,145	-----	976	10,000	17' 6"	P	Gasoline		
16	-----	152	96	150	18,330	-----	1,267	15,000	17' 6"	P	Gasoline		
17	Trucks, forklift, rough terrain.	204	96	90	15,200	-----	1,020	6,000	12	P	Gasoline	Primarily for transporting unit loads short distances. May be used for stacking. Less expensive than forklift trucks, but less maneuverable.	
18	Trucks, platform--	240	96	100	23,200	24,000	1,330	10,000	12	P	Gasoline		
		86	31	-----	-----	-----	-----	4,000	4"	-----	Electric		
								Drawbar pull (lb)					
19	Tractors, ware- house.	87	41	64	2,900	2,910	134	2,000		S	Electric		Used for drag towing on skids or towing one or more trailers.
20	-----	93	42	62	3,260	3,260	144	2,600		P	Gasoline		
21	-----	111	66	57	5,220	-----	252	4,000		P	Gasoline		Tractor is small and maneuverable; should be used for moving when distance exceeds 250 ft.
22	-----	116	66	62	5,800	5,870	277	4,000		P	Gasoline		
23	-----	86	42	59	3,500	3,650	131	4,000		S	Electric		
24	-----	130	96	72	9,500	-----	520	7,500		P	Gasoline		
								Load (lb)					
25	Cranes, wheeled, swinging boom.	139	63	72	12,855	-----	365	6,000		S	Electric	Handles loads of shapes and size which are moved with difficulty	

See footnotes at end of table.

	1	2	3	4	5	6	7	8	9	10	11	12
1	Item ¹	Dimensions			Weight (lb)		Displacement (cu ft)	Capacity		Type of tires ² S-solid rubber P-pneumatic	Method of operation	Primary use
		Length (in)	Width (in)	Height (in) minimum	Operating	Shipping		Load (lb)	Height (ft)			
26	-----	295	94	95	20,800	20,800	1,525	10,000		P	Gasoline	by other equipment.
27	-----	273	96	260	20,000	20,320	1,441	10,000		P	Gasoline	
28	Trucks, straddle--	192	96	159	14,800	16,500	1,733	30,000		P	Gasoline	Used extensively for moving lumber, poles, pipe, rods, and girders.

¹ All items of materials handling equipment not listed here. Typical items of varying capacities are listed. For more complete information, see TM 10-1619.

² Solid rubber-tired vehicles are used for hardstand; pneumatic-tired for unimproved terrain.

Section X. DISTRIBUTION

5.69. Routine Requisition and Shipping Times

The following table illustrates the times required to process routine bulk shipment of supplies. Days shown are for illustrative purposes only and represent an average of the probable minimum and maximum time intervals for processing a wide variety of items under varying conditions. Such intervals will increase or decrease depending upon the length and complexity of the requisition, the class of supply, the distance of the theater from the zone of interior, availability of transport, the type of transportation and handling facilities employed, workload on the various installations, and other factors.

	Days	
	Min	Max
Consolidated inventories and preparation of requisition in theater	5	15
Air mail time to port of embarkation	2	5
Port of embarkation edits and extracts requisition	3	10
Mail time to depot in zone of interior	5	5
Depot processes requisition and sets up shipment	15	125
Transit time from depot to port of embarkation	5	15
Port of embarkation loads and ships	10	15
Transit time from port of embarkation to theater	10	60
Port of discharge unloads supplies and moves them to depots	5	10
Total elapsed time from date requisition initiated until the supplies are available for issue in theater of operations	260	160

¹ Days shown assume that the supplies are carried in stock. Requisitions for supplies which require special procurement may increase this period by 6 to 12 months (see par. 5.57).

² Special or emergency requisitioning procedures, establishment of priorities, special handling procedures, and utilization of air transport may reduce this figure by half. Where supply is expedited by use of high speed communication equipment the figures will be reduced by responsible agencies.

5.70. Army Repair Parts Supply System

a. The Army repair parts supply system is based upon selective stockage, one line requisitions, and electronic transmission and processing of data. Requisitions are processed through field army, communications zone, and oversea supply agencies to zone of interior depots by means of high speed communication equipment. When coupled with centralized stock control

high speed data processing equipment, expedited transport to include through shipment to the ultimate consumer, the system offers substantial reduction in order and shipping times.

b. The system as applied to the supply of repair parts to US Army forces in Europe indicates the following time factors:

	Method of shipment	
	Emergency	Normal
Processing at field army and CommZ level	5 days	7 days
Processing at oversea supply agency	1 day	1 day
Processing at ZI depot	7 days	15 days
Shipment to port	6 days	9 days
At port and in transit overseas	6 days	18 days
Oversea distribution	5 days	10 days
Total	30 days	60 days

c. Actual time factors achieved to date are as follows:

Category	Definition	Method of shipment	Total resupply cycle
1	Nonstocked item causing deadlined equipment.	Air	30
2	Stockage list item for replenishment.	Water	60
3	Stockage list item with a zero balance and an emergency requirement.	Air	30
4	Nonstocked item not causing deadlined equipment.	Water	60

d. This system, when fully implemented and applied to all classes of supply, offers promise of reducing routine order and shipping times to the following averages:

Normal surface transport (10 days' voyage time)	35 days
Expedited surface transport	20 days
Air transport	10 days

5.71. Buildup of Supply Levels

a. For estimation of requirements when it is desired to build up a certain level of supplies by a given date, at the same time adequately supplying present and future contemplated operations during the buildup period, the following formula is useful:

$$S = C \left(1 + \frac{L}{T} + W \right)$$

when—

S equals shipping requirements during the buildup phase, expressed in pounds per day.

C equals *consumption* (average) in pounds per day.

W equals a *wastage factor* (percentage of total consumption expressed as a decimal). This factor is based on experience in the particular theater and normally ranges from 0 to .25.

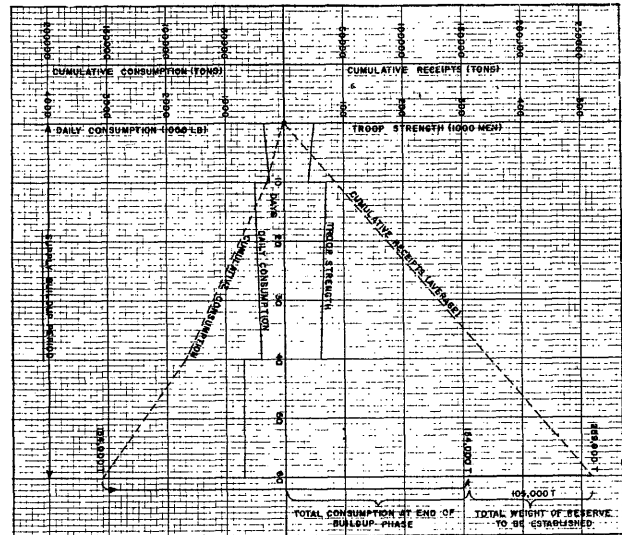
L equals the *supply level to be attained*, expressed in days of supply.

T equals *time length of buildup phase* in days.

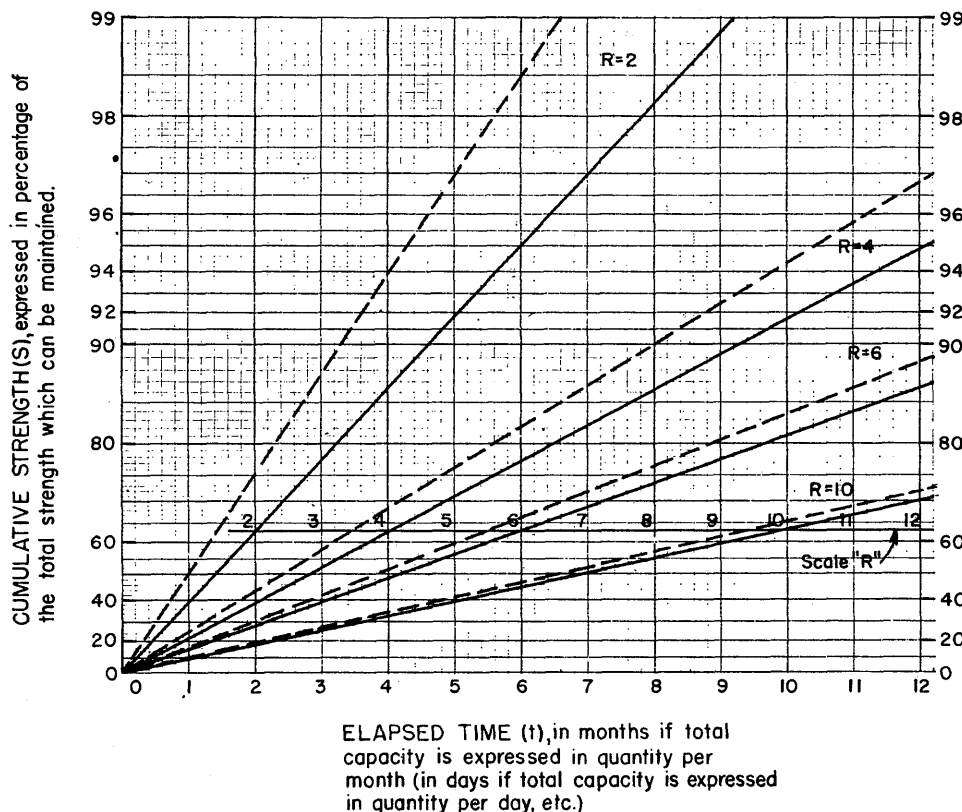
(Given any four of the factors, the fifth can be determined by transposing.)

b. Since the formula in *a* above assumes a constant troop strength, a chart similar to the following may be used to show the relation between changes in troop strength, the cumulative consumption, and cumulative receipts in the

establishment of a specified level of supply during a given buildup period.



5.72. Lines of Communication Buildup Capacity



a. General.

- (1) The preceding chart indicates the maximum cumulative strength which can be built up in the shortest time, using lines of communication of fixed

capacity, if these lines of communication also carry replenishment loads for personnel previously transmitted.

- (2) The chart is applicable to situations in which maintenance loads are directly

proportional to loads previously carried (initial loads) and has been prepared for the values 2, 4, 6, and 10 of R (ratio of initial to maintenance loads). Additional lines can be added readily to the chart for additional values of R .

- (3) For each value of R , there are shown 2 lines on the chart—1 solid and 1 dashed. For each value of R , use of the solid or dashed line in computations depends upon the assumption applicable to the situation—

(a) The solid-line curve in each case is based on the assumption that at any time t , the strength being served on a maintenance basis, is equal to the accumulation of strength previously served on an initial basis (that is, maintenance begins immediately upon passage, and initial loads are not alternately depleted and replenished).

(b) The dashed-line curve in each case is based on the assumption that the increment of strength served on an initial basis in any 1 month will be served on a maintenance basis during the following month (that is, initial loads would be depleted, on the average, by approximately 15 days' maintenance supply before replenishment would begin).

b. *Construction of Curves for Additional Values of R .* To construct curves for values of R , other than those shown, proceed as follows:

- (1) For solid lines (see assumption in a(3) above), draw a straight line through the origin (0, 0) and the point on scale R representing the value of R (ratio initial/maintenance loads).
- (2) For dashed lines (see assumption in a(3) above), draw a straight line through the origin (0, 0) and the point on scale R which is less by 0.5 than the value of R .

c. *Examples of Use of Chart.* This chart may be used in calculations relating to the movement of troops or supplies through a port of embarkation or, analogously, to their movement over any available lines of communication—for example, a railroad, a highway, an air transport

route. It can be used to determine the time it would take to reach various strengths, the strength which can be accumulated in any amount of time, and the necessary shiploads of initial or maintenance supplies. The ratio R may be based on space requirements; number of cars, ships, tonnages; number of individuals; etc.

(1) *Example 1.*

(a) *Problem.* The capacity of a port is 300,000 MT/month. Initial equipment for troops moving through the port = 4.8 MT/man; supplies for maintenance of troops moved through the port = 0.8 MT/man/month. What strength can be built up through this port in 7 months if maintenance supply for the troops begins immediately with their passage?

(b) *Solution.*

1. $R = \text{initail} \div \text{maintenance load} = 4.8 \div 0.8 = 6$.
2. $t = \text{time elapsed} = 7$ months.
3. From the chart, locate $t = 7$ on the horizontal scale, and continuing vertically upward to the intersection of $t = 7$ with the *solid* line for $R = 6$, read "Cumulative Strength (s)" from the vertical scale = 69 percent of the total strength which can be maintained.
4. Total strength which can be maintained = $300,000 / 0.8 = 375,000$ troops.
5. Therefore, cumulative strength after 7 months = 69 percent of $375,000 = 259,000$ troops.

(2) *Example 2.*

(a) *Problem.* Assuming the same circumstances in example 1 above, how many new troops will be moved through the port during the seventh month?

(b) *Solution.*

1. Proceed as in the solution to example 1 above, except determine the cumulative strength after 6 months = 64 percent of the total strength which can be maintained.
2. From the solution to example 1 and the foregoing, it is observed

that from the end of the sixth to the end of the seventh month (that is, during the seventh month), the cumulative strength changed from 64 percent to 69 percent of the total strength which could be maintained.

3. Therefore, the new troops moved in during the seventh month represent 69 less 64 percent = 5 percent of the total strength which can be maintained = 5 percent of 375,000 = 18,750 troops.

(3) *Example 3.*

- (a) *Problem.* Assuming the circumstances as in example 1 above, except that the maintenance factor of 0.8 MT/man/month is so established that maintenance can start during the following month for all troops moved initially during any 1 month, what could be the strength built up after 7 months?

(b) *Solution.*

1. Proceed as in the solution to example 1 above, except that in using the chart, use the *dashed* line for $R = 6$ instead of the solid line.
2. Read cumulative strength = 72 percent of the total strength which can be maintained.
3. Cumulative strength after 7 months = 72 percent of 375,000 = 270,000 troops.

(4) *Example 4.*

- (a) *Problem.* Initial and maintenance supplies for service forces are to be moved over a highway the capacity of which is 10,000 short tons per month. Initial equipment for these forces averages 3,350 pounds per man; maintenance averages 430 pounds per man per month. When will the size of the service force have been built up to 60 percent of its ultimate strength, if maintenance supply must begin immediately upon passage of the forces?

(b) *Solution.*

1. $S = 60$ percent of the maximum which can be supported.

$$2. R = 3,350/430 = 7.8.$$

3. Inasmuch as no line for $R = 7.8$ appears on the chart, it must be constructed. Observing the assumption in the problem above as to initiation of maintenance, draw a *solid* line through (0, 0) and the point 7.8 on scale R (in accordance with directions above).

4. Using the constructed line, as indicated in previous examples, determine for $S = 60$ percent that $t = 7$ months.

5.73. Combat Zone Supply Installations

a. *General.*

- (1) Listed in the following chart are the army supply installations usually found within the combat zone, showing in detail the class of supply for which each technical service is responsible and the normal supply installations for each class of supply. For each class of supply, the following are shown: the depots found in the field army service area; the supply points required to support the corps; and the normal procedure by which divisions or similar using units draw the specific classes of supply.
- (2) The supply system within the field army must be simple and, above all, flexible to meet changing situations. Mission, terrain, weather, road, and rail nets affect selection of locations for supply installations.
- (a) On the offensive, the supply points are well forward and contain at least 2 to 3 days of supply for the unit or units being served. As a general rule, two class I, class III, and class V supply points support each corps, located well forward in the area but out of heavy artillery range. Engineer class II and IV supply points might also be established if the conditions of roads and bridges require large quantities of construction materials. In addition to the medical depots, there normally will be two advance medical supply points, each supporting for-

ward evacuation hospitals and divisions.

- (b) On the defensive, the engineer class II and IV supply points should be located well forward, containing fortification materials. The other supply points should be located farther to the rear and normally would carry 3 days' level for the troops supported.
- (c) Normally, transportation Army aviation maintenance companies will be located in the vicinity of an airstrip.
- (3) Supply points serve all units in the

area. (If field army troops are located near a supply point, then that supply point will serve those units.) All army supply points are operated by army troops. All supply installations located in the corps or division area are cleared for area locations by corps or division before they are established.

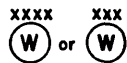
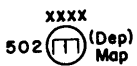
- (4) The tables show the type of supply installations needed to support a field army under normal conditions. Ground reconnaissance is the only method for selecting sites for installations.

b. Installations.

1	2	3	4
Item	Field army service area	Corps area	Unit supply procedure ¹
1 Chemical classes II and IV	1. Installation: chemical class II and IV depot. 2. Conventional sign: XXXX 301  (Dep) 3. Two such depots normally in army service area. 4. Wholesale issue to class II and IV supply points, retail to army troops. 5. Operated by one or more chemical depot companies depending on size of army and on gas or nongas warfare conditions. 6. Levels established by theater. Will normally be 5 to 15 days.² 7. Covered storage required—approximately 80 percent. 8. Maintenance is furnished in or adjacent to this depot for chemical material by chemical maintenance companies.	1. Installation: chemical class II and IV supply points. 2. Conventional sign: XXXX 303  (Sup Pt) 3. When necessary. Normally one per corps operated by chemical combat support company. 4. Normally retail issue. 5. Levels established by army. 6. Covered storage required—approximately 50 percent. 7. Maintenance is furnished in or adjacent to this supply point by chemical combat support company.	1. Battle groups and separate units will consolidate and submit requirements of subordinate elements to division chemical officer. 2. Division chemical officer consolidates requirements of division and submits requisition direct to army chemical officer or chemical combat support company. If supplies are regulated, requisitions are normally submitted through command channels or to army chemical officer for approval, based on army or corps commander's priorities.⁵ 3. Field army normally delivers supplies to division trains area, where supplies are broken down by division chemical officer. 4. Division continues unit distribution to divisional units. 5. Corps troops submit requirements to corps chemical officer, who then assembles the requirements and requisitions on army chemical depot or supply point. 6. When supplies are ready for issue, corps troops will normally draw directly from chemical combat support company.
2 Chemical class V.	1. Installation: chemical class V depot. 2. Conventional sign: XXXX 302  (Dep) 3. One such depot normally established as part of each ordnance class V depot, with the ordnance class V conventional sign. Depending on the army commander's desire, it may be located in army service area in proximity to the	1. Installation: Chemical class V supply point. 2. Conventional sign: XXXX 304  (Sup Pt) 3. Normally a part of or included in ordnance ASP. One or more of these supply points may be established in corps area depending on needs of using troops located in proximity of the ordnance ASP. Depending on the army	1. Battle groups and separate units will draw ammunition from the army ASP supporting corps, based upon ammunition requisition approved by division ammunition officer. Normally the quantity requested is to replenish the basic load. 2. Corps troops accomplish their own ammunition requisition, or equivalent, and draw requirements directly from ASP in corps area. 3. Corps controls the issue of class V chemical supplies to corps troops, if necessary.

		ordnance class V depot. - Wholesale issue to ammunition supply points (ASP); retail to army troops. - Operated by one or more chemical depot companies depending on size of army and on gas or nongas warfare conditions. - Levels established by theater. Normally 5 to 15 days of operation.² - Covered storage required—negligible. - When required, army allocates class V supplies to corps. Copy of allocation to ASP. - Mixed flamethrower fuel is normally carried in class V depot. (When units do their own mixing, they draw gasoline from class III supply point serving them and draw napalm from chemical class V depot or ASP.)	commander's desire, it may be established as part of the ordnance ASP. - Retail issue to corps and divisions. - Operated by a section of chemical combat support company. - Levels established by army; usually 2 to 3 days of operation. - When required, corps allocates class V chemical supplies to divisions and corps troops. - Supply point receives copies of army and corps allocations. - See note 9 in column 2.	- Division, if necessary, controls the issue to subordinate units. - All ammunition issues to divisions are coordinated through division ammunition officer. - Division units will draw ammunition directly from army supply points.
3	Engineer classes II and IV.	- Installation: engineer class II and IV depot. - Conventional sign: XXXX 501  (Dep) - Normally one per army located in army service area. - Operated by engineer depot company (TOE 5-267). - Level—5 to 15 days (5,000–20,000 tons).² Large quantities of construction materials, lumber, steel, and road material may be procured locally and not pass through the depot system. - Class II—issued on replacement or exchange basis on receipt of requisition approved by engineer supply officer of divisions and corps troops. Requests in excess of allowances require corps and army engineer approval. - Class IV—issued on request of unit engineer supply officer. - Regulated items—see note 5.	- Installation: engineer class II and IV supply points. - Conventional sign: XXXX 511  (Sup Pt) - Normally one per corps. Operated by engineer supply point company (TOE 5-48). - Level—3 days (250–400 tons). Stockage generally consists of fortification or bridge materials. Corps bridge units may carry additional stocks of bridging materials. - Maintenance companies maintain small stocks of fast-moving items and issue first, second, and third echelon parts for issue to the maintenance section of the infantry and armored division engineer battalions. Replenishment is from army engineer depots.	- A division engineer dump carrying limited quantities of selected items may be operated by the division engineer battalion. It is located either at the headquarters and headquarters company of the engineer battalion or is consolidated with other divisional services near the rear echelon. In any case, fortification and camouflage materials may be left in the infantry battle group areas, when desired. This latter method is more normal. - Class II—units requisition through division engineer. - Class IV—units request informally through division engineer. - Regulated items require approval of army engineer before items can be drawn from army depot or supply points, based on army or corps commander's priorities.⁵ - Supplies are brought to the division area by field army. - Repair parts may be obtained through depot system or through supporting engineer maintenance company.

See footnotes at end of table.

1	2	3	4
Item	Field army service area	Corps area	Unit supply procedure ¹
	9. Maintenance companies maintain small stocks of fast-moving items and issue first, second, and third echelon parts for issue to the maintenance section of the infantry and armored division engineer battalions. Replenishment is from army engineer depots.		7. Repair parts sections of infantry and armored division engineer battalions maintain small stocks of fast-moving first, second, and third echelon items obtained from supporting engineer field maintenance companies or depot system. Other units obtain repair parts through supporting engineer field maintenance companies.
4 Engineer water.	1. Conventional sign:  2. Normally one per army. 3. Production: 540,000 gal—1 day. 4. Distribution: 14,400-gal tank load. 5. Storage capacity: 108,000 gal. 6. Used to supplement water sources of army, corps, and division engineers, to transport water to units without a sufficient local source, and to transport water to installations which use large quantities of water and have inadequate means to transport it.	1. Installation: engineer water point. 2. Conventional sign:  3. One to four points may be established by each corps and army engineer battalion. 4. Maximum production, each battalion—168,000 gal. 5. Maximum storage, each battalion—36,000 gal. 6. Issue is made to all consumers who arrive at water point with empty containers. 7. Amphibious or airborne operations—water points of organic units can be in operation on D-day, 4 hours after arriving at source. Five days of supply often taken ashore in 5-gal drums and 55-gal drums and issued with class I supplies.	1. Installation: Division water point. 2. Conventional sign:  3. One to five points may be established by the infantry division engineer battalion. 4. Production and storage capacity same as for corps engineer battalion. 5. Issue is made to unit kitchen trucks and water trailers, which are sent to water points and transport water to unit kitchens.
5 Engineer maps.	1. Installation: engineer map depot. 2. Conventional sign:  3. Normally one in army service area located near army headquarters. 4. Operated by map reproduction and dis-	1. Corps may operate map depot to supply division and corps troops. 2. Issues made to corps troops and divisions on basis of army table of map allowances. 3. Maps obtained from corps topographic company and army topographic battalion.	1. Division troops receive maps from division engineer battalion, which distributes maps under the staff supervision of division G2. 2. Division engineer obtains maps from the corps engineer. 3. Division usually requires 1 medium-scale map, 1 road map, and 2 large-scale maps.

		tribution company. - Issues made to army troops, corps, and divisions on basis of army table of map allowances. - Normally one engineer topographic battalion performs new mapping, photomapping, reproduction, and survey methods. Lithography and contact prints—size 22" x 29". - Maps are obtained from army topographic battalion and base map depots in communications zone.		
6	Medical classes II and IV.	- Installation: medical class II and IV depot. - Conventional sign: XXXX 801 ⊕ (Dep) - Normally two per army located in army service area. - Operated by army medical depot (TOE 8-667). - Army level—5 to 15 days.² - Depot restocks advance supply points and makes retail issues to units located in army service area. - Regulated items require approval of the army surgeon, based on army commander's priorities.⁵ - Ninety percent of supplies require covered storage.	- Installation: medical class II and IV supply point. - Conventional sign: XXXX 851 ⊕ (Sup Pt) - Located within easy reach of evacuation and field hospitals. - Normally there will be two advance supply points (supporting all corps) with the primary mission of making bulk issues to division and retail issues to other units and hospitals. - Level—2 to 3 days.	- Division medical battalion consolidates the requirements of the units of the division and draws in bulk from the nearest medical supply point. - Field army makes unit distribution to divisions, and unit distribution continues within the division normally through medical channels. - Army medical units draw direct from nearest medical supply point.
7	Medical laboratory.	- Installation: medical laboratory. - Conventional sign: XXXX + 5802 Lab - Located in army service area. - Carries a stock of laboratory supplies for army medical units.		Army medical units draw <i>laboratory supplies</i> from army medical laboratory located in army service area.

See footnotes at end of table.

	1	2	3	4
	Item	Field army service area	Corps area	Unit supply procedure ¹
8a	Ordnance classes II and IV (less vehicles and artillery).	1. Installation: ordnance class II and IV depot. 2. Conventional sign: XXXX 901  (Dep) 3. Normally two or more located in the army service area. 4. Operated by one or more ordnance field supply companies (TOE 9-57). 5. Issues to army ordnance direct and general support maintenance units and division ordnance units. Transportation normally by army TC units. 6. Supply level—5 to 15 days of selected items.	1. Army ordnance direct support maintenance units and division ordnance units maintain stocks of selected fast-moving items. Using unit is provided supply and maintenance support by the same ordnance unit. 2. Issues to using units. Transportation by army TC or ordnance units, division TC or ordnance units, or unit transportation. 3. Supply level—5 to 15 days for using units supported and ordnance shop activities.	1. Division units submit requirements to division ordnance unit. Other units submit requirements to supporting army ordnance direct support maintenance unit. 2. Nonregulated items issued on requisition or direct exchange of serviceable items for unserviceable items. 3. Regulated items issued on requisition within allocation by division, corps, or army.⁵ 4. Division ordnance units and army ordnance direct support maintenance units draw supplies in bulk from ordnance class II and IV depot to maintain stocks.
8b	Ordnance classes II and IV (vehicles and artillery only).	1. Installation: ordnance park. 2. Conventional sign: 903  (Park) 3. Normally two or more in the army service area. 4. Operated by ordnance park company (TOE 9-137) and ordnance direct support and general support maintenance units as required. 5. Issues to army ordnance direct and general support maintenance units and division ordnance units. Transportation normally by ordnance park company or army TC units. 6. Supply level—5 to 15 days of selected items.² Part of this level may be located in army ordnance maintenance units and/or division ordnance units.	1. Army ordnance direct support maintenance units and division ordnance units receive and issue vehicles, trailers, and artillery received from ordnance park. 2. Issues to using units. Transportation normally by using unit. 3. Supply level—variable. Stocks in army ordnance maintenance units and division ordnance units are— a. Part of army ordnance park supply level. b. Stored for issue to using units. c. Utilized as maintenance float for exchange of serviceable items for unserviceable items.	1. Division units submit requirements to division ordnance unit. Other units submit requirements to supporting army ordnance direct support maintenance unit. 2. All items are normally regulated and issued on requisition within allocations by division, corps, or army.⁵ Direct exchange of serviceable items for unserviceable items will be effected within maintenance float capability of supporting ordnance unit
9	Ordnance class V.	1. Installation: ordnance class V depot.	1. Installation: ordnance class V supply	1. Battle groups and separate battalions

	2. Conventional sign: XXXX 910  (Dep) 3. Normally two or more located in the army service area. 4. Operated by one or more ordnance ammunition companies (TOE 9-17). 5. Receives from communications zone. Maintains principal army reserve. 6. Issues to: - Ammunition supply points as required. Transportation by army TC units. - Using units in army service area. Transportation by using unit. 7. May store and issue chemical class V. 8. Supply level—3 to 8 days.² Total army supply level, depot and ASP, is 5 to 15 days.	point (ASP). 2. Conventional sign: XXXX 911  (ASP) 3. Normally two or more per corps located in corps rear areas. 4. Operated by ordnance ammunition company (TOE 9-17). 5. Normally receives from communications zone. Transportation by communications zone TC units. May receive from army ordnance class V depot. Transportation by army TC units. 6. Issues to army, corps, and division units in corps area to fill approved ammunition requisitions. Transportation by using unit. 7. May store and issue chemical class V. 8. Supply level—2 to 7 days.²	consolidate requests from companies and batteries. 2. Ammunition requisitions are normally for quantities required to fill unit basic loads or in anticipation of immediate expenditure. 3. Division units submit ammunition requisitions to division ammunition officer (DAO) for approval. Corps and army units submit ammunition requisitions to designated corps and army representatives for approval. Approving officers normally do not consolidate requisitions. 4. Using units present approved ammunition requisitions to designated ordnance class V supply point, or depot, and draw ammunition in unit transportation.
10	Quartermaster class I. 1. Installation: class I depot. 2. Conventional sign: XXXX 601  (Dep) 3. Normally located well forward in army service area and may operate in two or more locations. 4. Operated by 1 quartermaster subsistence depot company and 5 quartermaster service companies. 5. Can handle supplies for 400,000 troops. 6. Unless items such as flour, sugar, etc. are in waterproof containers, limited storage is desired. 7. Levels are established by theater army. Class I level is 5 to 10 days, based on army's consumption rate.² 8. Supply point in army service area located to serve army troops. A portion of the	1. Installation: class I supply point. 2. Conventional sign: XXXX 651  (Sup Pt) 3. At least one per corps.³ 4. Located as far forward in corps rear area as possible. Should be out of heavy artillery range; dispersed for atomic defense; on a good road net; located to support units of the corps; as concealed as possible; army must secure corps clearance for area location. 5. Can supply corps of 100,000 troops. 6. Operated by one quartermaster subsistence supply company when issuing type B or C rations. If type A rations are issued, the unit should be augmented by one platoon of a quartermaster service company.	1. Infantry division and armored division. - Battle groups of the infantry division and battalions of the armored division consolidate requirements for companies and submit consolidated requirements to division quartermaster; separate battalions consolidate for their units and submit requirements to division quartermaster; attached units submit their requirements to division quartermaster. - Division quartermaster consolidates class I requirements for division and attached units and submits direct to army class I supply point. - Infantry division. - Army transportation hauls from army supply point to division distributing point, where rations are broken down for major units, separate bat-

See footnotes at end of table.

1	2	3	4
Item	Field army service area	Corps area	Unit supply procedure ¹
	depot may be set aside for issue to army troops located near the depot.	7. Also located in army service area to serve army troops. 8. Levels for army supply points are established by army. Normally 2 to 5 days for units supported. In the offense, 2 to 3 days. In defense, 3 to 5 days.	talions, and separate companies. Division transportation battalion hauls from division distributing point to units (unit distribution). d. Armored division. (1) Army transportation hauls from army supply point to division distributing point, where rations are broken down for major units, separate battalions, and separate companies. (2) Units come back to division distributing point for their supplies (supply point distribution). 2. Airborne division. a. Supplies air delivered to supply and transportation company in the air-head. After linkup, army hauls from army supply point to division distributing point. b. Division supply and transportation company hauls from division distributing point to units (unit distribution).
11 Quartermaster class III.	1. Installation: class III depot. 2. Conventional sign: XXXX 620  (Dep) 3. Normally located well forward in army service area and may operate in two locations. 4. Operated by 1 quartermaster petroleum depot company and 2 quartermaster service companies. 5. Can handle class III supplies for 400,000 troops.	1. Installation: class III supply point. 2. Conventional sign: XXXX 621  (Sup Pt) 3. At least one per corps.³ 4. Location—same as for class I. 5. Can supply corps of 100,000 troops. 6. Operated by one quartermaster petroleum supply company. 7. Two or more supply points also located in army service area to serve army troops.	1. Infantry division and armored division. a. Division quartermaster consolidates class III requirements for division based on unit requests and anticipated requirements. b. Division quartermaster hauls from army supply point to division distributing point. c. Unit or supply point distribution within division. 2. Airborne division. a. Class III air delivered to supply and transportation company in the air-head. After link-up, army hauls from army supply point to division

		6. Levels are established by theater army. Normally class III level for army is 5 to 10 days, based on army's consumption rate.² 7. Supply points for class III located to serve army troops. A portion of the depot may be set aside for issue to army troops located near depot. 8. Normally two class III supply points located in the army service area.	8. Levels for army supply points are established by army. Normally 2 to 5 days for units the supply point supports. In the offense, 2 to 3 days. In defense, 3 to 5 days.	distributing point. b. Supply and transportation company hauls from distributing point to units (unit distribution). 3. Normally, any vehicle going to the rear and passing by a class III supply point refills with gasoline before returning to the forward area. 4. Class III is moved in bulk from as far forward as possible.
12	Quartermaster classes II and IV.	1. Installation: quartermaster class II and IV depot. 2. Conventional sign: XXXX 600 (Dep)  3. Normally located in army service area and may operate in two locations. 4. Operated by 1 quartermaster clothing and general supply depot company and 1 quartermaster service company. 5. Can handle class II and IV supplies for 400,000 troops. 6. Covered storage required—90 percent. 7. Levels are established by theater army. Normally, class II and IV level 5 to 15 days, based on army requirements.² 8. Army commander allocates regulated items to subordinate units.⁵	1. Corps units follow same procedure as for division troops except that requisitions are consolidated by battalion and submitted to army quartermaster class II and IV depot. 2. Corps allocates regulated items to corps troops and divisions. Requisitions for regulated items must be approved by army quartermaster, based on army commander's policies.⁵	1. Infantry division and armored division. a. Battle groups of the infantry division and battalions of the armored division consolidate requirements for classes II and IV for companies and submit consolidated requisitions to division quartermaster. b. Division quartermaster consolidates or assembles the requirements for the division, to include attached units, and submits same to class II and IV depot except for regulated items, which are submitted to army quartermaster.⁵ c. Infantry division. (1) Army transportation hauls from army class II and IV depot to division distributing point. (2) Division transportation battalion hauls from division distributing point to units (unit distribution).⁴ d. Armored division. (1) Army transportation hauls from army class II and IV depot to division distributing point, where supplies are broken down for major units. (2) Units come back to division distributing point for their supplies (supply point distribution).⁴

See footnotes at end of table.

1	2	3	4
Item	Field army service area	Corps area	Unit supply procedure ¹
			2. Airborne division. a. Supplies air delivered to supply and transportation company in airhead. After link-up, army hauls from army class II and IV depots to division distributing point. b. Supply and transportation company hauls supplies from division distributing point to units (unit distribution).⁴
13 Signal classes II and IV.	1. Installation: signal class II and IV depot. 2. Conventional sign: XXXX 701  (Dep) 3. Normally two located in army service area. 4. Operated by two signal depot companies (TOE 11-158), which are part of army signal supply and maintenance battalion (TOE 11-155). 5. Can handle class II and IV supplies for army. 6. Covered storage required for 75-90 percent of tonnage. 7. Army units draw from signal depot, based on army signal officer's approval. 8. Army level—5 to 15 days. 9. Regulated items require approval of army signal officer, based on army commander's policies.⁵	1. Installation: Signal class II and IV supply and maintenance point. 2. Conventional sign: XXXX 703  (Sup and Maint Pt) 3. Normally one per corps. Operated by forward signal supply and maintenance company (TOE 11-157), which is part of army signal supply and maintenance battalion (TOE 11-155). 4. Normally corps units follow the same procedures as for divisions. 5. Based on army's allocation of regulated items to corps, corps allocates regulated items to corps troops and divisions. Requisitions for regulated items must be approved by the army signal officer, based on the army commander's policies or priorities of issue.⁵ 6. Nonregulated items are issued on requisition or direct exchange of serviceable items for unserviceable items.	1. Units prepare single line item requisitions as requirements develop and submit, without consolidation, through battle group to division signal officer. Division signal battalion maintains a small stock of fast-moving items for immediate issue to division units. 2. When items cannot be supplied within division, the division signal officer submits the requisition, without consolidation, to the army signal depot and maintenance point. 3. The army signal supply and maintenance point effects unit distribution when feasible. Otherwise, the division supply section will pick up supplies or make arrangements for units to do so. 4. Division signal supply section arranges for unit distribution to maximum extent possible. When impossible, units will be notified to pick up supplies at the division signal dump when they have been procured. Some wire and the more common batteries are kept on hand and are available within reason by coming for them. 5. All signal units are authorized a prescribed load of wire and fast-moving items, such as common batteries and radio tubes. 6. Nonregulated items will be issued to, or

				be obtained for, division units on requisition or direct exchange of serviceable items for unserviceable items.
14	Transportation Army aircraft classes II and IV.	1. Installation: transportation Army aircraft class II and IV depot. 2. Conventional sign: XXXX 405  (Dep) 3. At least one located in the army service area. 4. Operated by the transportation general support aircraft supply company. 5. Provides supply support to the transportation transport aircraft supply companies, transportation aircraft intermediate support companies, and transportation general support aircraft maintenance companies. 6. Levels established by theater. Will normally be 30 days. 7. The transportation aircraft intermediate support company located in the army service area will furnish supply support to aircraft assigned to units within that area. <i>Note.</i> Transportation Corps items, such as life preservers, are stored in engineer class II and IV depots.	1. The transportation aircraft intermediate support company in each corps issues Army aircraft class II and IV supplies to the divisions, transportation aircraft direct support company, and other nondivisional units in the corps area, excluding transportation air transport units. 2. Nonregulated items are issued on requisition or direct exchange of serviceable items for unserviceable items. 3. Regulated items are issued on allocations by corps or army. 4. Supply level—15 days for units supported plus sufficient for own maintenance activities.	1. Divisions and nondivisional units in forward areas requisition and receive supplies through transportation aircraft intermediate support companies. 2. Transportation helicopter battalions requisition and receive supplies from transportation transport aircraft supply companies. 3. Nondivisional units operating Army aircraft from locations in the vicinity of the transportation general support aircraft supply company may requisition directly from that unit when such action is more economical. 4. In all cases, the flow of supplies may either be through the intermediate support unit or direct from the transportation general support aircraft supply company. Economy and expeditious resupply dictate the channels for the flow of supplies.

¹ The phrase "consolidate supply requirements" means for the unit to consolidate into *one requisition* the requirements for its subordinate and attached units. The phrase "assemble supply requirements," means for the unit to collect and edit the supply requirements for its subordinate units and forward these requirements as *separate requisitions for each subordinate unit*. Normal procedure is for divisions to include supply requirements for units attached to the division. This procedure is followed except when the unit is attached for a short period of time.

² General levels established by theater which are considered a part of theater stocks do not include levels in supply points, except for class V supplies.

³ Nature of terrain and lines of communication sometimes require additional supply points to support one corps.

⁴ Normally, units of the division will come to division trains area to pick up their class II and IV requirements. When unit distribution of supplies is possible, class II and IV supply requirements will be delivered to the unit by the same transportation which delivers class I supply.

⁵ Regulated items—requisitioned through command channels—however, may be issued against approved command allocations or priorities subject to approval of chief of technical service. At appropriate echelons, the latter authority may be delegated to depot commanders.

CHAPTER 6

LOGISTICS—EVACUATION AND HOSPITALIZATION

Section I. ESTIMATE OF PATIENTS

6.1. Classification of Patients

a. The term *patient* includes all military personnel excused from duty because of illness, nonbattle injury, and battle wound or injury. For most purposes discussed in this chapter, only those patients who require hospitalization or who are excused from the performance of military duty and not returned to duty within the calendar day of admission to a medical treatment facility need be considered. Patients may be classified in several ways, depending upon the purpose for which such classification is made. It is important to note that not all casualties or nonbattle losses are patients.

b. In making estimates of patients or in computing hospital bed requirements, patients are usually classified by cause of disability into *disease*, *nonbattle injury*, and *battle wound or injury*. The latter group falls in the category of battle casualties.

c. Patients may be classified as *hospital patients* or *quarters patients*.

d. In calculating evacuation requirements, patients may be classified by—

- (1) Severity of disability, into *walking* and *litter* patients.
- (2) Suitability for evacuation, into *transportable* and *nontransportable* patients.
- (3) Suitability for evacuation by air.
- (4) Type of accommodation required for evacuation, into *recumbent* and *sitting* patients.

6.2. Admission Rate

The incidence of disease, injury, and wounding is usually expressed in the military services in terms of the number of admissions per 1,000 average strength per year. The admission rate may be for all causes, for all diseases, for all nonbattle injuries, or for all battle wounds or injuries. The admission rate may also be computed for specific diseases or types of injuries. For purposes of logistical estimation or for planning for hospitalization requirements, the

admission rate is most conveniently expressed as a *daily admission rate to hospital per 1,000 average strength*.

Daily Admission Rate to Hospitals Per 1,000 Strength—All Causes¹

Years	Total Army	ETO	MTO	Pacific
1942–1945	1.48	1.04	1.83	1.53
	Total Army	ETO	FECOM	Korea
1950–1953	0.83	0.72	0.95	1.07

¹In using experience factors from theaters of operation, it must be borne in mind that battle injury and wound rates are not primarily related to geography. In utilizing such rates for planning purposes, it is necessary to consider the theater from the standpoint of type of combat, size and organization of forces, weapons employment, etc.

6.3. Disease and Nonbattle Injury

a. Diseases and nonbattle injuries among frontline troops of a seasoned command in campaign, except in a particularly unhealthful region, may be expected to produce a daily admission rate to medical treatment facilities (hospital and quarters combined) of about 3 per 1,000 per day (0.3 percent per day). This average rate can be expected at certain seasons of the year, without epidemics, to reach 0.5 percent or even more. As a rough rule of thumb, *one-third* of these patients may be expected to remain under treatment in their own organization (at aid stations or collecting stations) or in the division clearing stations *if there is no interference with the primary mission of reception, treatment, and evacuation of casualties*. About two-thirds of the disease and nonbattle cases may be evacuated from the division area. Thus, *one-third* of the patients are *quarters* cases and *two-thirds* of the patients are *hospital* cases.

b. The daily admission rate to hospitals, from disease and nonbattle injuries, may be shown as follows:

Daily Admission Rate to Hospitals Per 1,000 Strength—Disease and Nonbattle Injury

Years	Total Army	ETO	MTO	Pacific
1942–1945	1.42	0.80	1.62	1.44
	Total Army	EUCOM	FECOM	Korea
1950–1953	0.78	0.72	0.72	0.73

This daily admission rate to *hospital* would correspond to an admission rate to *hospital and*

quarters of about 0.3 percent and soon would result in a constant noneffective rate of about 4.5 percent. For unseasoned troops in the same climatic condition, the noneffective rate might reach 6 percent and would be even higher under unfavorable conditions of climate and location.

c. On the basis of experience in the Mediterranean Theater of Operations during World War II for *disease and nonbattle injury*, it may be expected that about 0.2 percent will die, 4 percent will be evacuated to the zone of interior, and the remainder, 95.8 percent, eventually will return to duty. The average stay in hospitals in a theater for nonbattle cases admitted to hospitals overseas during World War II was about 19 days; while the total average hospitalization, including time spent in zone of interior hospitals, was about 25 days.

d. For planning purposes, certain additional estimated daily hospital admission rates from *disease and nonbattle injuries* in oversea commands during recent years are as follows:

<i>Estimated Disease and Nonbattle Injury Hospital Admission Rate (Admissions Per 1,000 Average Strength Per Day)</i>	
<i>Major oversea command</i>	<i>Daily rate per 1,000</i>
Alaska	0.9
Austria	.8
Caribbean	1.0
Europe	1.0
Far East	1.2
Pacific	.9
Trieste	1.1

The rates shown above have been prepared to provide current data for future planning. The data have been based on Army experience over the 2 fiscal years from July 1950 through June 1952. It should be borne in mind, however, that these rates reflect an experience unlike that of World War II. During World War II, U. S. Army troops were engaged in combat in several major oversea areas. In the experience on which the above rates have been based, all areas were free from the effect of combat with the exception of the Far East. Because of such limitations, care should be exercised in the use and interpretation of the data shown above.

6.4. Casualties

a. In estimating battle injuries and wounds, many variable factors must be considered. These include type of troops, their location in the theater, type of engagement, enemy capa-

bilities, etc. For this reason, it is desirable in such estimations to separate all troops in a theater into groups having approximately the same casualty rate and compute the patients separately for each group on the basis of their numerical strength. For example, in a given theater the troops might be grouped into front-line divisions, other ground troops in the combat zone, Air Force troops, and troops in the communications zone. Each of these groups would have a different battle injury and wound rate, and the total patients in the theater would depend upon the relative strength of each group.

b. The average daily admission rates for casualties in various theaters during World War II were as follows:

<i>Daily Admission Rate to Hospitals Per 1,000 Strength—Battle Injury and Wound¹</i>				
<i>Years</i>	<i>Total Army</i>	<i>ETO</i>	<i>MTO</i>	<i>Pacific</i>
1942-1943	0.06	0.24	0.21	0.08
1944-1945	0.10	0.26	0.22	0.10
	<i>Total Army</i>	<i>EUCOM</i>	<i>FECOM</i>	<i>Korea</i>
1950-1953	0.05	----	0.22	0.34

¹ In using experience factors from theaters of operation, it must be borne in mind that battle injury and wound rates are not primarily related to geography. In utilizing such rates for planning purposes, it is necessary to consider the theater from the standpoint of type combat, size and organization of forces, weapons employment, etc.

c. In estimating battle injury and wound patients in an army, an estimate based on front-line divisions engaged usually will be more accurate than one based on a rate for corps or the army as a whole.

d. Considerable variation in battle injury and wound admission rates among Air Force troops occurs, depending upon the type of aircraft, type of mission flown, and amount of enemy air resistance. As an overall average, which necessarily must be modified to apply to any special situation, battle injury and wound admission rate for all air troops can be taken as 0.2 per 1,000 per day. More commonly, casualties in Air Force troops are computed on the basis of the number of man-missions flown.

e. The number of battle injuries and wounds among communications zone troops, except in special situations, has been negligible. However, planners in future warfare should consider the possibility of mass casualties in rear areas.

f. The ratio of killed and wounded among casualties has been estimated as follows (the figures do not include prisoners or persons missing in action).

World War II

Ratio of killed
to wounded—
World War II
and Korea

Infantry:

European Theater of Operations.....	1:4
Mediterranean Theater of Opera- tions	1:4
U. S. Army Forces in Pacific.....	1:4
All theaters combined.....	1:4
Total Air Forces, all theaters.....	5:4
Armored, all theaters.....	2:7
Artillery, all theaters.....	1:4

Korea

Infantry.....	1:4
Armored.....	1:4
Artillery.....	1:4

- (1) In temperate and tropic zones, the overall ratio of killed to wounded may be taken as 1:4.
- (2) In the arctic zones, the ratio of killed to wounded may be considerably higher because of death of the wounded from exposure to cold.
- (3) On the basis of experience in World War II (in general, 120-day evacuation policy), it may be expected that about 4 percent of the wounded who reach hospitals will die; about 25 percent will be invalided home, and the remaining 71 percent will be returned to duty in the theater. Of those evacuated to the zone of interior, about 45 percent will return to duty. The average stay of wounded personnel in over-sea and zone of interior hospitals in World War II was about 94 days.
- (4) Of the wounded who reached hospitals in World War II, about 4 percent died and about—
 - 15 percent recovered in 15 days.
 - 19 percent recovered in 15 to 30 days.
 - 17 percent recovered in 30 to 60 days.
 - 11 percent recovered in 60 to 90 days.

20 percent recovered after 90 days.
14 percent were separated from the Army.

- (5) In World War I¹, it was found that of the gas casualties who reached hospitals, approximately—
 - 2 percent died.
 - 25 percent recovered in 15 days.
 - 27 percent recovered in 15 to 30 days.
 - 24 percent recovered in 30 to 60 days.
 - 16 percent recovered after 60 days.
 - 6 percent were of no further military value.
- (6) In World War I¹, the average stay of gas casualties in oversea and zone of interior hospitals was 41.8 days.

6.5. Statistics

The following tables represent statistics from World War II. To be used as staff planning factors, they may require modifications, depending upon the conditions anticipated.

a. Average Daily Admission Rate Per 1,000 From All Causes.

Combat conditions	Inf div	Armd div	Abn div	Combat zone	CommZ
Heavy.....	8	7	11	5	1.5
Average.....	4	4	4	3	1.5
Light.....	2	2	2	2	1.5

b. Average Daily Admission Rate Per 1,000 Air Force Troops.

Location	Disease and non-battle injury	Battle injury and wound	Total
Pacific areas ¹	2.01	0.02	2.03
European areas ²	1.87	0.27	2.14
Average active combat.....	1.80	0.20	2.00

¹Includes Far East Air Forces, Twentieth Air Force, and China and Burma-India Air Forces.

²Includes Air Forces in European and Mediterranean Theaters of Operation.

¹The figures are based upon World War I chemical agents, tactics, and medical treatment methods. These figures may be expected to change greatly with modern chemical agents.

Section II. BED REQUIREMENTS

6.6. General

The hospital requirements of a theater of operations are computed in terms of total beds in hospitals capable of performing all types of treatment, not in terms of medical units. The total authorization to meet these requirements is expressed as the fixed-bed allotment of the theater of operations. Medical units of the combat zone and a convalescent center of the communications zone are not included in the computation. Field hospitals are included in this allotment only when they are to be employed as fixed hospitals. In general, the fixed hospital bed requirements of a theater of operations are satisfied by the assignment to the communications zone of appropriate numbers of general hospitals and station hospitals.

6.7. Basic Data

To compute bed requirements for any specific situation, certain basic data are necessary. These are the evacuation policy, daily admission rates, troop strengths, accumulation factor, and dispersion factor.

a. Evacuation Policy. The theater evacuation policy is established by the Department of Defense (usually upon the recommendation of the theater commander concerned). It specifies which patients will be evacuated to the zone of interior by designating a maximum number of days for the allowable period of hospitalization within the theater. Patients who, in the opinion of responsible medical officers, cannot be returned to a duty status within the period prescribed are to be returned to the zone of interior by the first available and suitable transportation, providing the travel required will not aggravate their disabilities. The periods considered may be 30, 60, 90, 120, or 180 days. A minimum of 90 days is regarded as desirable in order to arrive at an optimal balance between trained men retained in the theater and the medical means required to care for them.

- (1) *Evacuation policies within a theater* may be established for certain areas and for certain types of medical installations, specifying which patients will be evacuated to the next higher echelon of medical care. For example, the theater commander may establish

a 30-day evacuation policy for station hospitals. This would mean that all patients admitted to station hospitals whose recovery is likely to require more than 30 days would be evacuated to general hospitals. This would in no way affect the total fixed-bed requirements of the theater.

- (2) *Certain flexible evacuation policies*, useful as guides but varying with manpower policies, admission rates, and available beds, may be established for the combat zone. Similarly, evacuation policies for dispensaries may be specified.

b. Daily Admission Rates. See paragraph 6.2.

c. Accumulation Factor. Under a given evacuation policy, patients will accumulate in hospitals at a certain determinable rate, depending upon the admission rate, the type of disability, and the average period of hospitalization. Based upon experience in *both world wars*, these accumulation rates have been assembled into tables called *accumulation tables*. The accumulation factors given in such tables are based upon a daily admission rate of 1 per 1,000 strength and upon a specified evacuation policy. The condensed table below may be used when applicable.

Accumulation Factors

	1	2	3	4	5
1	Theater evacuation policy	Accumulation of patients in a hospital system per 1,000 strength, based on admission rates of 1 per 1,000 a day each for disease and nonbattle injury and for battle injury and wound			
		Disease and nonbattle injuries		Battle injuries and wounds	
		Total	Theater	Total	Theater
2	1-----	1.00	1.00	1.00	1.00
3	5-----	4.56	4.56	4.81	4.81
4	10-----	7.64	7.64	9.13	9.13
5	20-----	11.40	11.38	16.87	16.71
6	30-----	13.55	13.47	23.66	23.14
7	60-----	17.20	16.60	40.05	36.63
8	90-----	19.45	18.38	52.19	43.53
9	120-----	20.98	19.48	61.40	46.75

d. Dispersion Factor. At any given time, a certain proportion of theater fixed beds will not be immediately available to patients because of

“dispersion.” (A 20-percent allowance for dispersion was generally used during World War II.) Factors contributing to dispersion are—

- (1) A certain number of beds must be packed and in transit. The greater the mobility of the troops, the greater the allowance required.
- (2) Smaller troop units operating at some distance from the main body of troops must be supported by complete hospital units, even though it is realized that the troop unit will not be likely to utilize fully the hospital facilities provided.
- (3) The general practice of prescribing separate wards for patients of different sexes, cases of contagious diseases, and for cases requiring different types of treatment necessitates a safety margin in each ward since the proportion of the various classes will vary from time to time.

6.8. Computations

a. General. Given these items of basic data, the fixed hospital bed requirements for a specific situation at a given time can be computed according to the following formula: (Note that a factor of 1.25 is applied to obtain a dispersion allowance of 20 percent as defined in par. 6.7*d*.)

Example: Theater A has a troop strength of 500,000. Expected daily admission rates per 1,000 are as follows: disease and nonbattle injuries 1.7; casualties, 0.6. Theater evacuation policy is to be 90 days. How many fixed hospital beds will be required?

	Rate	Accumulation factor	Troop strength thousands	Dispersion factor	
Disease and nonbattle injuries	1.7	18.38	500	1.25	= 19,529
Battle injuries and wounds	0.6	43.53	500	1.25	= 16,324
Total fixed beds required at the end of 90 days					35,853

b. Atomic, Biological, and Chemical Warfare. While the preceding computations afford a relatively sound basis for determining fixed-bed requirements, atomic, biological, and chemical warfare introduces other factors. The experience factors presented in this chapter have been derived in the presence of a certain pattern of wounding and are related to average admission rates over long periods. The pattern of wounding from atomic, biological, and chemical weapons will probably alter accumulation factors. Of greatest significance, however, may be the characteristic wide fluctuation of daily admission rates resulting from these weapons. This characteristic may render any attempt to employ average admission rates futile. The problem will be one of handling recurring peak loads of patients. This problem must be met either by very efficient use of theater hospital facilities or by rapid and extensive evacuation to the zone of interior For this reason, the planner may find it more realistic to submit fixed-bed requirements as a feasible percentage of troop strength supported and build the maximum flexibility into the resulting medical service.

6.9. Zone of Interior

a. Fixed beds are required in the zone of interior for those troops who do not depart for theaters of operation. When new recruits are being inducted in large numbers, morbidity tends to be rather high and beds equal in number to as much as 5 percent of the zone of interior strength may be necessary. After the period of training is over, beds equal in number to about 4 percent of the zone of interior strength may be sufficient.

b. It also is necessary to compute bed requirements for those cases evacuated from theaters of operation. These additional beds are estimated on the basis of the expected numbers of evacuees arriving in the United States (disease and nonbattle injury and casualty cases being separately considered) and the average duration of stay of such cases in zone of interior hospitals.

**Accumulation of Theater of Operations Patients in Zone of Interior Hospitals—
120-Day Evacuation Policy¹**

	1	2	3	4	5	6	7	8
1	Cause of admission	Daily hospital admission rate per 1,000	Accumulation of theater patients in zone of interior hospitals per 1,000 theater strength after number of days indicated following start of operations in the theater					
			60	90	120	180	260	540
2	Disease and nonbattle injury	1.0	0.60	1.07	1.50	3.11	4.08	4.17
3	Wounded	.6	2.05	5.20	8.79	16.32	26.43	28.48
4	Total patients		2.65	6.27	10.29	19.43	30.51	32.65
5	Increase by 26%		.66	1.57	2.57	4.86	7.63	8.16
6	Total beds required		3.31	7.84	12.86	24.29	38.14	40.81

¹Based on July to December 1944 ETO admission rates.

c. To the above figures must be added an allowance, when appropriate, for care of *Navy, Air Force, Allied military personnel, Allied civilians, and prisoners of war*. The additional number of fixed beds for such purposes will depend upon the particular area involved, and no definite figures can be given.

d. Experience in World War II indicates that an additional allowance should be made because some patients who are to be evacuated to the zone of interior still will be in the theater after 120 days because of a change in prognosis, transportation allocation, or other reasons.

Section III. TRANSPORTATION OF PATIENTS

6.10. Capacity of Transportation

	1	12	3
1	Type of transportation	Men	
		Sitting	Recom- bent
2	Transport airplane (C-46)	40	33
3	Transport airplane (C-47)	24	24
4	Transport airplane (C-54)	49	36
5	Transport airplane (C-82)	42	34
6	Transport airplane (C-97)	134	83
7	Transport airplane (C-119)	62	35
8	Transport airplane (C-123)	60	50
9	Transport airplane (C-124)	200	132
10	Transport airplane (C-130)	92	74
11	Army aircraft (L-19E)	1	
12	Army aircraft (L-20B)	5	2
13	Army aircraft (L-23D)	5	
14	Army aircraft (U-1A)	9	4
15	Army helicopter (H-13G)	2	2
16	Army helicopter (H-19D)	10	6
17	Army helicopter (H-21C)	20	12
18	Army helicopter (H-23C)	2	2
19	Army helicopter (H-34A)	12	8
20	Army helicopter (H-37A)	23	24
21	Army helicopter (H-40)	2-3	2
22	Bus, motor, 37-passenger, convertible ..	37	18
23	Truck, ambulance, frontline, ¼-ton, 4 x 4.	5	2

	1	12	3
1	Type of transportation	Men	
		Sitting	Recom- bent
24	Truck, ambulance, field, ¾-ton, 4 x 4 ..	8	5
25	Truck, ambulance, light, 3-litter	3	3
26	Truck, cargo, 2½-ton, 6 x 6	16	18
27	DUKW	25	12
28	Railway car, coach (US)	52	
29	Railway car, coach (foreign)	54-72	
30	Pullman car (US)	48	32
31	Sleeping car (foreign)	32	32
32	Ambulance car, ward (US)	35	35
33	Ambulance car, ward (foreign)	30	30
34	Ambulance car, personnel (foreign)	21	21
35	LVT	12	6
36	LCVP	36	² 17
37	LCM (6)	120	30
38	LCM (8)	³ 200	⁴ 50
39	LCU	400	100
40	LST	180	120

¹ Exact figures for Army aircraft in columns 2 and 3 must be computed on maximum gross weight. See paragraph 7.44b.

² Only seven litters if LCVP is to be hoisted aboard for loading.

³ In addition to recumbent patients.

⁴ In addition to sitting patients.

6.11. Time Element of Evacuation

Following are factors for evacuation of personnel (including loading and unloading) :

a. Litter Squads.

- (1) Average terrain, 4-man squad—1,000 yards and return in 1 hour.
- (2) Mountainous terrain, 6-man squad—400 yards and return in 1 hour.

b. Ambulance, Motor, During Combat, in Division Area. Five miles and return in 1 hour.

c. Aircraft.

- (1) Helicopter—50 miles 1 way in 1 hour.
- (2) Transport airplane—100 miles 1 way in 1 hour.
- (3) Army aircraft—75 miles 1 way in 1 hour.

CHAPTER 7

LOGISTICS—TRANSPORTATION

Section I. GENERAL

7.1. Chapter Contents

This chapter contains detailed data on transportation capabilities and methods of computing transportation requirements. The contents have been organized to present a general section on transportation planning and a separate section on each of the major means of transportation required to support military operations.

7.2. Transportation Estimates and Plans

a. Transportation estimates and plans are necessarily dependent upon the user of transportation, whose firm requirements are often not available until after tactical plans and supply service plans have been completed. In order for transportation planners to plan concurrently with other staff agencies, it is often necessary for them to adopt methods of utilizing troop strength and requirement factors that will permit a reasonable estimate of transportation requirements in broad terms, to be defined at a later date in terms of class and service (or item) of supplies and categories of personnel or troop units.

b. Transportation planning embraces the following:

- (1) Surveying existing and potential facilities for movement of troops and supplies.
- (2) Selecting the available means of movement which provide the greatest flexibility, based upon a study of the existing and potential facilities.
- (3) Planning for the maximum utilization of carrying capacity.
- (4) Insuring that the transportation plan provides for flexibility.

7.3. Capabilities of Lines of Communication

a. The capabilities of lines of communication are quantitative statements of the ability of the lines to transport cargo or troops and are usually expressed in tons (long or short) or troops per day. Frequently, troops per day may be equated to tons per day to provide a common

unit of measure. A ton-mile is the actual movement of 1 ton 1 mile. A *forward* ton-mile is the actual *forward* movement of 1 ton 1 mile and provides for the return trip of the carrier.

b. Capabilities are dependent upon the following factors, one of which will always limit the capability of the line of communication:

- (1) Capacity of the transportation means, which is dependent upon density and speed of movement. Density is dependent upon speed, which, in turn, is dependent upon the physical character of the way. Critical density is the density of traffic when the volume is at possible capacity of the roadway. At a density either greater or less than critical density, the volume of traffic will be decreased. Critical density occurs when all vehicles are moving at or about optimum speed.
- (2) Number and lift capacities of available transportation mediums.
- (3) Turnaround time (time required for a complete cycle of movement), which is dependent upon speed of transportation mediums; speed of loading and unloading; and time consumed in maintenance, miscellaneous delays, and operation en route.
- (4) Efficiency of management and maintenance organization.

c. Efficiency of management is an intangible factor, which may enter arithmetical calculations of capability only by experience or estimate. Such efficiency is dependent on number and skill of operating personnel, degree of intelligent movement planning, and effectiveness of operating technique.

7.4. Advance Transportation Planning Factors

When it is desirable to obtain an estimate of transportation requirements well in advance of detailed planning, the following general averages may be used:

a. Cargo Ships.

Capacity	5,600 short tons of Army cargo.
Discharge rate	720 short tons per day discharging alongside berth.
Discharge rate	720 short tons per day discharging in stream.
Beach capacity	1,680 short tons per 1,000 yards of beach.
Amphibious truck capacity	720 short tons per amphibious truck company per day.
Loading rate	500 short tons per day loading alongside berth or in stream.
Light, medium, and heavy boat company capacity.	1,440 short tons per boat company per day.

b. Shipping Requirements for an Assault Division Slice of 25,000 Men.

Type	Extended voyage (10 days)	Short voyage (2-3 days)
AGC (amphibious forces flagship)	1	
APA (transport, attack)	10	1
AKA (cargo ship, attack)	2	2
LST (landing ship, tank)	25	50
LSD (landing ship, dock)	7	7
CVHA (aircraft carrier, assault, helicopter)	6	6

c. *Port and Beach Operations.* Unless other factors govern to provide dispersion and to present less favorable targets to the enemy, plans should provide for the discharge of not less than 40 percent of tonnage over the beach and through shallow draft facilities. As friendly capabilities decrease and as destructive magnitude of enemy weapons increases, this "over the shore" proportion should be increased in order to reduce dependence on major ports to support military operations.

d. *Percentage of Organizations and Supply Moved in Assault or Cargo Craft in Amphibious Operations.* Supply as used below refers to accompanying supply. After the assault phase, supply is by cargo shipping only, except for emergency supply. Percentages are as follows (to be used only when assault lift is not known):

- (1) Eighty percent of the total personnel moved in assault naval shipping.
- (2) Twenty percent of the total personnel moved in cargo type shipping.
- (3) Sixty percent of the organizational equipment and supplies for units moved in assault naval shipping will

accompany the units transported in that shipping.

- (4) Forty percent of the organizational equipment and supplies for units moved in assault naval shipping will be transported in cargo type shipping.
- (5) Because of space or other factors, it sometimes is not possible to move all of the organizational equipment and supplies of a unit on the same ship. These supplies and equipment, in such case, may be moved on another ship of the same convoy, provided sufficient personnel from the parent unit accompany them.

e. Railways (foreign countries)¹.

(1) Standard gage (56½ in.).

Single track-----10 trains (4,000 short tons) per day in each direction (will support about 6 divisions).

Double track-----30 trains (12,000 short tons) per day in each direction (will support about 18 divisions).

Train load-----400 short tons of cargo (20 cars at about 20 tons each) or 1,000 troops (40 boxcars at 25 troops each).

(2) Narrow gage (36 in., 39⅜ in., and 42 in.).

Single track-----10 trains (3,000 short tons) per day in each direction.

Train load-----300 short tons of cargo (20 cars at about 15 tons each) or 500 troops (20 boxcars at 25 troops each).

f. Highways.

(1) Highway tonnage capability.^{2 3}

Dirt	1,600 short tons/day fwd.
Gravel	3,400 short tons/day fwd.
Bituminous	7,300 short tons/day fwd.
Concrete	8,400 short tons/day fwd.

¹ For planning purposes, new carload (payload) is computed at 50 percent of its rated capacity. U.S. equipment overseas box, gondolas, and flat cars, 40 tons rated capacity (standard gage); 30 tons rated capacity (narrow gage).

² No exact formula has been developed for determining the capabilities of various types of roads and highways because of many variable factors which must be considered. These capabilities are based on the following assumptions: (1) operation is sustained; (2) necessary road maintenance is performed; (3) each road bears two lanes of traffic, permitting movement in both directions; (4) standard cargo trucks, 2½-T, 6 × 6, are used; (5) two-thirds of the capability of the road is used for civil and/or other military traffic normal to a theater of operations.

³ Maximum possible.

- (2) A hard-surfaced, 2-lane road of high-type asphalt, macadam, or equivalent will support a corps of 4 or 5 divisions.
- (3) Trucks required to move the foot troops of an infantry division—246 vehicles less any available vehicles from the infantry division transportation battalion.
- (4) A transportation light truck company (TOE 55-17) equipped with 2½-ton, 6 x 6, cargo trucks is capable of moving 720 short tons of general cargo for local hauls daily or compiling 18,000

forward ton-miles daily on line or long hauls.

g. Pipelines. A 6-inch pipeline will transport 2,000 short tons of petroleum products per day.

h. Air Transportation. To transport the initial echelon of an infantry division by air requires 836 C-119 or C-123 type aircraft. Sufficient personnel, weapons, and vehicles are included so that the infantry division can operate with same degree of combat effectiveness as the assault echelon of an airborne division. For detailed aircraft requirements, see TT 7-100-2.

Section II. TERMINALS

7.5. General

a. Types. A terminal is either end of a carrier line, such as a railroad, trucking line, shipping line, or air line. It normally includes servicing, repair, and maintenance facilities; classification yards; dock and lighterage facilities; management offices; storage facilities; and freight and passenger loading and unloading facilities as required. The three types of terminals treated in this section are—

- (1) Water terminals.
 - (a) Ports.
 - (b) Beaches.
- (2) Inland terminals.
- (3) Air terminals.

b. Elements of Terminal Planning. There are normally five steps in terminal planning:

- (1) *Step 1.* Computation of the terminal workload required to support the operation, expressed as cargo tonnage and number of personnel per day.
- (2) *Step 2.* Estimation of the existing terminal capacity, which is the total tonnage and personnel that can be *received, processed and cleared* through the terminal in a day.
- (3) *Step 3.* Estimation of construction requirements, which are the requirements for repair and rehabilitation of existing facilities and construction of new facilities necessary to increase the existing terminal capacity to equal the required terminal workload.
- (4) *Step 4.* Estimation of the equipment requirement, which is the amount of

equipment needed to process the required workload through the terminal with the maximum efficiency.

- (5) *Step 5.* Estimation of the personnel requirements, which are the units and individuals needed for administration and operation in processing the required workload through the terminal.

7.6. Water Terminals (Ports)

a. General. This paragraph deals with planning data for water terminals in the hands of the enemy, but which are to be opened for operation as soon as cleared. For this reason, data are based on the employment of Army personnel and ships' gear only for the unloading of ships. Appropriate allowances should be made for other circumstances, such as availability of civilian labor and terminal facilities; i.e., gantry cranes, barges, railway, etc. Ship discharge will be accomplished by 1 of 2 methods—either from vessels alongside a wharf onto the wharf, or by lighters from a vessel anchored astream. Throughout the discussion of water terminals in this paragraph, the basic period of time is a 20-hour day. This is generally considered to be a complete round-the-clock working day in terminal operations, the other 4 hours of the day being taken up in delays inherent in the work, such as breakdowns, waiting for trucks, changing shifts, and meals. (For planning of terminal discharge in forward areas when enemy action may be expected to cause work delays, 15 hours' working time per day may be estimated. Factors used may be reduced proportionately.) For general planning

purposes, the transportation terminal service company is considered capable of discharging 720 short tons per 20-hour working day.

b. Water Terminal Capacity Estimation.

(1) *Factors.* Terminal throughput capacity is determined by three major factors. In all instances, one of these will be the limiting and thereby determining factor. Each of the three factors may be expressed in terms of short tons per day for planning and estimating purposes. All three factors should be accurately estimated even though the limiting factor may be obvious. These estimates will serve to indicate the facilities where im-

provement effort will yield the greatest return in terms of tonnage movement capability. The three major factors are—

- (a) Terminal reception capacity; that is, the ability to move ships into the harbor or coastal area of the terminal.
- (b) Terminal discharge capacity; that is, the ability to accommodate ships in the harbor and to discharge them.
- (c) Terminal clearance capacity; that is, the ability to accomplish terminal clearance.

(2) *Checklist for terminal capacity estimation.*

Collect and evaluate these data

Compute these factors

Determine this figure

- 1. Channel depths_____
- 2. Obstructions _____
- 3. Enemy air activity_____
- 4. Enemy surface activity_____
- 5. Enemy submarine activity_____
- 6. Climate _____
- 7. Weather _____
- 8. Minefields or contaminated areas_____
- 9. Our own capabilities in combating obstacles.
- 1. Tactical dispersion requirements_____
- 2. Wharf facilities_____
- 3. Beach capabilities_____
- 4. Discharge rates ashore_____
- 5. Discharge rates astream_____
- 6. Anchorage area_____
- 7. Extent of destruction or contamination_____
- 8. Climate and seasons_____
- 9. Weather and tide characteristics_____
- 10. Cargo-handling equipment available_____
- 11. Floating craft and equipment available_____
- 12. Transit sheds and areas_____
- 13. Availability of indigenous labor_____
- 14. Space reserved for local economy_____
- 15. Enemy activity_____
- 1. Capacity of rail facilities_____
- 2. Capacity of highway facilities_____
- 3. Capacity of inland waterway facilities_____
- 4. Capacity of pipeline facilities_____
- 5. Capacity of air facilities_____
- 6. Enemy activity_____

(a) Evaluate to determine:

A. Water terminal reception capacity.

(b) Evaluate to determine:

B. Water terminal discharge (input) capacity.

(c) Add to determine:

C. Water terminal clearance (output) capacity.

Water terminal throughput capacity.

(a) These data will probably be obtained from Navy sources; also see paragraphs 7.49 through 7.56.

(b) For information on beaches, see paragraph 7.7.

(c) Capabilities of transport services—pipeline, inland waterway, rail, highway, air transport—are shown in paragraphs 7.10 through 7.28, and 7.42 through 7.48.

c. *Wharf Facilities.*

(1) *General.* Since only two methods of ship discharge are available (*a* above), general planning must consider wharf facilities for alongside and lighter discharge. The Victory type ship having five hatches is used as a basis for all discharge. It was selected since it so closely meets the average characteristics of a nominal ship. Deep-draft wharfage must be provided whenever *alongside* discharge is contemplated. Shallow-draft wharfage and anchorage areas must be given joint consideration when lighter discharge is contemplated. Factors governing wharfage will be found in (2) and (3) below. The term *wharf* is used throughout in its general meaning; i.e., a structure used to aid in the berthing, loading, and discharge of a vessel. Specific definitions of ship berthing facilities are as follows:

- (a) *Wharf.* A wharf is a projecting platform of timber, stone, or other material which extends into water deep enough for vessels to be accommodated alongside for loading or unloading.
 - (b) *Quay.* A quay is a wharf parallel with the shoreline of a basin or harbor with water and accommodations for ships on one side only.
 - (c) *Pier.* A pier is a wharf which projects into the harbor or basin with water and accommodations for ships on both sides.
- (2) *Deep-draft wharf requirements.* A wharf is classified as deep-draft when the water alongside is deep enough to permit a fully loaded ship to tie up alongside. The following criteria will govern:
- (a) *Water depth.* Water depth should be not less than 30 feet at low tide. A minimum of 30 feet is used for planning purposes since this will accommodate virtually all deep-draft vessels.
 - (b) *Length for Victory type ship, 500-feet.* Each hatch (5 per vessel) will require 100 feet of wharf. When

wharfs are over 500 feet long and less than the next higher 500-foot unit, the odd footage is disregarded in determining the number of berths available (that is, 1,200 feet will accommodate only 2 ships at the same time). However, the extra 200 feet can be considered for lighterage use (3) below.

- (c) *Width.* Width should be 60 to 90 feet for discharge on 1 side of wharf only; 90 feet and up for discharge on both sides of wharf. For planning and estimating purposes, a wharf should be 60 to 90 feet wide to allow sufficient working space to discharge cargo from a ship. In the case of a pier where 2 vessels can tie up at the same time, 1 on each side, it is recommended that the width be 90 feet or more for efficient discharge.

(3) *Lighterage wharf requirements.*

- (a) *General.* Any wharf may be used for lighter discharge if the water depth is sufficient for the type of lighterage being used. It may include wharfage that dries out at low tide but which can be used half the time or 10 hours per day.
- (b) *Length for lighter.* Wharfage length for a lighter should be 100 feet. Length of wharfage over 100 feet and less than the next higher 100-foot unit is disregarded (that is, a 350-foot wharf will handle 3 lighters at the same time).
- (c) *Width.* A minimum of 35 feet is recommended for discharge on 1 side—42 feet for discharge on both sides of pier.

d. *Discharge Rates.*

- (1) *Per ship berth (Victory type).* Seven hundred and twenty short tons per 20-hour day (5 hatches at 7.2 short tons per hatch per hour).
- (2) *Per lighter berth.* One hundred and eighty short tons per 20-hour day (1.8 short tons per linear foot of wharf per 20-hour day).

e. *Anchorage Areas.* Anchorage areas are defined as shelter areas inside or near a harbor,

unaffected by swell, where ships may anchor and discharge by lighter.

- (1) *Depth.* Minimum, 30 feet; maximum, 210 feet. The minimum depth is dictated by the draft of the ship, and the maximum by the length and weight of the anchor chain. Installed facilities, such as mooring buoys, may modify maximum depth limitations.
- (2) *Free-swinging anchorage area.* Eight-hundred-foot radius circle.
- (3) *Moored bow and stern.* Variable; this method is not preferred since it can be used only in areas unaffected by tidal currents.

f. Estimate of Water Terminal Operating Personnel and Equipment.

- (1) *General.* To insure maximum efficiency in terminal operations, a balanced operating force of general and special service units, supervisory elements, and suitable equipment must be available. Extreme care must be exercised during both the planning phase and actual operating phase to insure that a balance is established and maintained. The possibility of using civilian and prisoner of war labor should not be overlooked, particularly in later expansion of the water terminal.
- (2) *Operating personnel.* Operating personnel are divided into managing, or supervisory, elements (such as headquarters and headquarters company, terminal commands A, B, or C) and functional general and special service operating units. In this last category may be included terminal service companies or battalions, truck companies, engineer general and special service units, harbor craft units, and such other units particularly suited for the functioning of any particular water terminal. Units commonly found in a water terminal are listed below:

Headquarters and headquarters company, transportation terminal command C (TOE 55-111).

Headquarters and headquarters company, transportation ter-

minal command B (TOE 55-121).

Headquarters and headquarters company, transportation terminal command A (TOE 55-131).

Headquarters and headquarters detachment, transportation terminal battalion (TOE 55-116).

Transportation terminal service company (TOE 55-117).

Headquarters and headquarters company, transportation truck battalion (TOE 55-16).

Transportation light truck company (TOE 55-17).

Transportation medium truck company (TOE 55-18).

Transportation heavy truck company (TOE 55-28).

Transportation aerial tramway company (TOE 55-87).

Floating craft crews (TOE 55-500).

Transportation staging area company (TOE 55-147).

Military police battalion (TOE 19-55).

Engineer utility detachment (TOE 5-500).

Engineer firefighting team (TOE 5-500).

Finance disbursing section (TOE 14-500).

Medical dispensary team (TOE 8-500).

Veterinary food inspection detachment (small) (TOE 8-500).

Quartermaster service company (TOE 10-67).

Signal service team (TOE 11-500).

Army postal unit (TOE 12-605).

Ordnance motor vehicle assembly company (TOE 9-348).

Ordnance ammunition team (TOE 9-500).

g. Special Cargo Handling Equipment. Requirements for general planning purposes to handle 720 short tons of general cargo daily into an established terminal or beach operation or to load 500 short tons of general cargo daily are as follows:

1	2	3	4	5	6	7	8	9
		Forklifts						
	Cranes	4,000-lb load	6,000-lb load, rough terrain	10,000-lb load, rough terrain	15,000-lb load, rough terrain	Stevedore gear sets	Lighters	Conveyors
Transportation terminal service company, TOE 55-117. ¹	3 10-ton 1 40-ton 2 20-ton	} 5	5	4	2	7 ea cargo set, general hatch. 1 ea of 8 sp cargo sets.	12 lighters or 4 LCU; or 12 LCM.	20 sections (10 ft) and 5 curves.

¹ Items shown in columns 2-7 and 9 are authorized in TOE 55-117.

h. Operating Equipment. Equipment necessary for terminal operations can be separated into two categories:

- (1) *The first category*, equipment directly employed in ship discharge and cargo movements, includes such items as cranes, forklift equipment, trucks, tractors, harbor craft, lighters, railway engines and cars.
- (2) *The second category*, equipment supporting the terminal operations, includes all maintenance utilities, power generators, repair shops.
- (3) For details of operation and capacity of terminal operating equipment, see the following references:

FM 55-51. *Transportation Terminal Commands, Theater of Operations.*

FM 55-52. *Transportation Terminal Battalion and Terminal Service Company.*

FM 55-53. *Transportation Amphibious Truck Company.*

FM 55-110. *Transportation Port Companies, Military Stevedoring.*

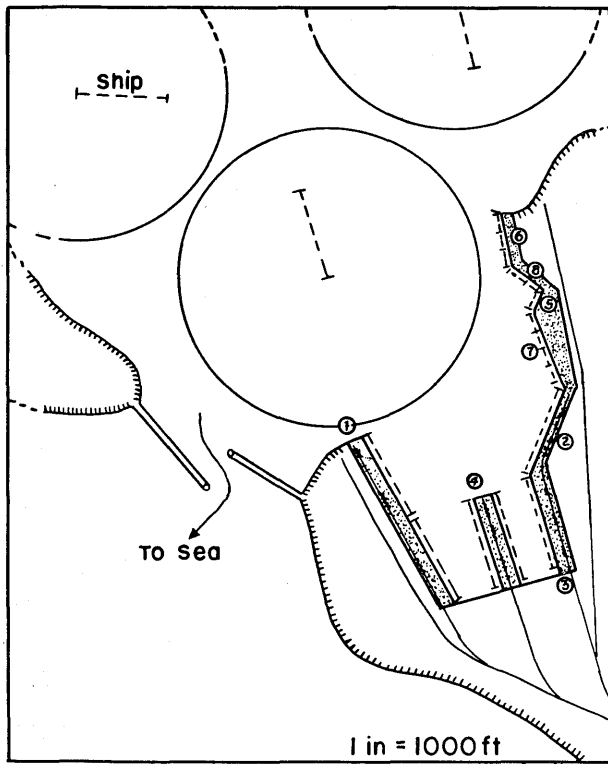
i. Illustrative Example of Water Terminal Capacity Estimation. The following example has been provided to demonstrate the recom-

mended procedure for water terminal capacity estimation based upon the steps and data outlined in the preceding paragraphs.

- (1) *Situation.* A true-scale chart of a certain harbor has been prepared for evaluation. With reference to this chart, the following additional information has been assembled:

1	2	3	4
Wharf No.	Length (feet)	Width (feet)	Minimum depth alongside at low tide (feet)
1-----	1,060	80	32
2-----	490	60	30
3-----	580	90	30
4-----	535	100	34, each side
5-----	125	54	8
6-----	295	60	15
7-----	450	75	22
8-----	210	60	16

- (a) There is sufficient area inside the harbor to anchor three ships as shown, where they can be worked continuously.
- (b) In good weather, as many as two vessels can be anchored and worked outside the breakwater.
- (2) *Problem.* To estimate the daily capacity of this terminal during ideal weather.



(3) *Solution.*

(a) *Discharge tonnage at deep-draft wharfage.*

1	2	3
Wharf No.	Vessels which can be berthed	Rate of discharge in short tons per day
1.....	2 Victorys	$2 \times 720 = 1,440$
2.....	1 Victory	$1 \times 720 = 720$
3.....	1 Victory	$1 \times 720 = 720$
4.....	2 Victorys	$2 \times 720 = 1,440$
Total.....		4,320

(b) *Discharge tonnage to lighterage wharfs.*

1	2	3
Wharf No.	Lighter berths	Rate of discharge in short tons per day
5.....	1	$1 \times 180 = 180$
6.....	3	$3 \times 180 = 540$
7.....	4	$4 \times 180 = 720$
8.....	2	$2 \times 180 = 360$
Total.....		1,800

¹ The situation shows wharf 6 to be only 295 feet long. The criterion for lighter wharfage, as given in c above, limits this wharf to 2 lighters. However, since the 5-foot shortage will limit operations to no appreciable extent, it is feasible to use the 95-foot section for docking a third lighter. This has been done here.

(c) *Rate of discharge from ships at anchor to lighters.* From the situation, 3 ships can be anchored inside the breakwater, and 2 can be anchored and worked outside the breakwater in good weather. Therefore, in good weather, cargo can be discharged from ships to lighters at the rate of $(3 + 2) \times 720 = 3,600$ short tons per day.

(d) *Resultant daily terminal capacity—summary.*

1. Discharged alongside deep-draft wharfs—4,320 short tons per day.
2. Discharged from lighters to wharf—1,800 short tons per day.
3. Transferred from ships to lighters—3,600 short tons per day.
4. Therefore: 1,800 short tons per day is maximum discharge by lighter since lighter wharfage is the limiting factor in this case.
5. Total daily terminal capacity: 4,320 short tons per day, alongside.

1,800 short tons per day, by lighter.

Total 6,120 short tons per day.

(e) *Limitations on terminal capacity.*

Requirements for dispersion and limitations on the number of ships which can be grouped in one area may restrict the use of the facility to much less than its full capacity.

(4) *Effect of bad weather.* Advance study must be made to determine the probable effect of bad weather on rate of discharge and other factors in water terminal capacity. Continuous records of daily discharge plotted against weather and surf conditions prove valuable in planning future discharge in the same and similar water terminals.

(5) *Operating personnel and equipment.* Note that appropriate amounts of operating personnel and equipment must be provided to use the capacities of the physical facilities of the terminal.

7.7. Water Terminals (Beaches)

a. Amphibious Operations.

(1) Beach capacity.

(a) Each landing in an amphibious operation differs as to climatic and hydrographic conditions and variations in topographic features, as well as in the military situation. These variable factors make it impracticable to develop detailed logistical planning data applicable only to beaches and their capacity to receive troops and cargo. However, certain general planning data can be developed.

(b) Beach capacity is an evaluation of cargo quantities that can be discharged over a given lineal beach length within a stated interval of time. During the initial phases of an amphibious operation, beach capacity will be limited to the beach (or beaches) over which the assault landing is made; later, if necessary, overall capacity may be increased by the consolidation of beaches for more efficient operation and for the opening up of sheltered unloading points in rivers or bays. Experience has indicated that, during the *assault* phase of an operation, cargo can be landed and moved across beaches as follows (use either 1 or 2, or 1 and 2, together in proportionate combination):

1. Average short tons of cargo per day per mile of beach	3,000
(Average per 1,000 yards of beach	1,700)
2. Average numbers of vehicles and personnel landed simultaneously per day per mile of beach:	
Vehicles	675
Personnel	4,725

(2) *Ship-to-shore supply service.* A ship-to-shore supply service will include the following:

- (a) Unloading cargo from ships into landing craft or landing vehicles.
 - (b) Movement of cargo by landing craft or landing vehicles from ships to shore.
 - (c) Unloading of landing craft at beaches.
 - (d) Movement of cargo from beaches to beach dumps, transfer points ashore, and shore-based dumps.
 - (e) Unloading at dumps or transfer points.
- (3) *Requirements for ship unloading.* Facilities for unloading ships anchored offshore usually are limited to ships' organic gear. Using organic gear and stevedore labor provided by forces ashore, ships normally can discharge cargo into special landing equipment faster than beaches can receive and clear the loaded landing craft and vehicles.
- (4) *Characteristics of amphibious force vessels and craft.*
- (a) Data contained in this paragraph with reference to speed and endurance may vary under operational conditions.
 - (b) Designating letters and names are used in the following general manner:
 - 1. LC (landing craft) is applied to nonocean-going vessels of less than 200 feet overall length designed for landing operations.
 - 2. LS (landing ship) is applied to ocean-going vessels of more than 200 feet overall length designed for participation in landing operations.
 - 3. LV (landing vehicle) is applied to small equipment designed for landing operations and capable of use on land or water.

(c) Characteristics of small landing craft.

Name	Symbol	Length	Beam	Capacity		Draft (loaded)		Speed, loaded (knots)	Range (miles)	Crew	Weight (ltons) empty	Cargo space dimensions
				Troop	Cargo (ltons)	Forward	Aft					
Landing craft, vehicle-personnel ----	LCVP	36' 0"	10' 5"	36 or 3.5		2' 2"	3' 0"	10.5	135	4	8	17' 3" x 7' 5" x 5'
Landing craft, mechanized (Mark 3) -	LCM (3)	50' 0"	14' 0"	69 or 26.7		3' 6"	4' 6"	8	400 at 7 knots.	4	23.2	31' 6" x 9' 6" x 6' 4"
Landing craft, mechanized (Mark 6) -	LCM (6)	56' 0"	14' 0"	120 or 32		3' 0"	4' 8"	8	128 at 8 knots.	4	28	37' 6" x 9' 6" x 6' 4"
Landing craft, mechanized (Mark 8) -	LCM (8)	73' 8"	21' 0"	200 or 53.5		3' 0"	5' 0"	10	284	6	60	42' x 14' 6" x 11'
Landing craft, utility (1466 class) ---	LCU	115' 1"	34' 0"	300 or 135		3' 1"	4' 0"	7	700	12	180	52' x 26' 9" x 4' 6" plus 22' x 14' 4" x 4' 6"

(d) Characteristics of amphibious vehicles.

Name	Symbol	Length	Beam	Capacity		Speed L—land—mph W—water—knots	Range (miles) L—land W—water	Crew	Weight (ltons) empty	Example of material carried
				Troop	Cargo (ltons)					
Carrier, cargo -----	M29c	14' 5 $\frac{1}{16}$ "	5' 7 $\frac{1}{4}$ "	4 or	.2	32L 3.4W	175L 45.2W	2 to 4	1.7	Light cargo or personnel.
Carrier, personnel, tracked -----	M59	17' 11"	10' 8 $\frac{1}{2}$ "	11 or	1.5	32L 4.3W	120L —W	1	17.3	Personnel or light cargo.
Carrier, cargo, amphibious -----	M76	15' 7"	8' 2"	10 or	15	28L 3.4W	160L 24.6W	2	4.3	10 passengers (including crew).
Landing vehicle, tracked (Mark 4)	LVT (4)	26' 2"	10' 8"	24 or	4.5	15L 7W	150L 100W	2 to 7	12.3	1 med aid station (including $\frac{1}{4}$ -ton truck).
Landing vehicle, tracked (armored) (Mark 4).	LVT (A) (4)	26' 2"	10' 8"	-----	-----	15L 5.2W	150L 100W	6	15.7	None.
Landing vehicle, tracked (Mark 5)	LVTP (5)	29' 8"	11' 8 $\frac{1}{2}$ "	40 or	9L 6W	27.8L 6.7W	187L 45W	3	31.2	105-mm howitzer w/crew and 100 rnd ammo.
Landing vehicle, tracked, (armored) (Mark 5).	LVT (A) (5)	27' 2 $\frac{1}{2}$ "	10' 10"	-----	-----	20L 5.6W	150L 50W	5	15.7	None.
Landing vehicle, tracked (Mark 6)	LVTH (6)	29' 8"	11' 8 $\frac{1}{2}$ "	-----	-----	27.8L 6.7W	187L 45W	6	37.8	None.
Landing vehicle, tracked (Mark 6)	LVTP (6)	21' 7"	10' 9"	20 or	5L 4W	35L 5.5W	190L 45W	3	17.9	Bulk cargo.
Mortar, self-propelled, tracked ---	M84	18' 5"	10' 4"	6 or	1.6	30L 3.8W	90L —W	6	23.15	Mortar, 4.2-in.
Truck, 2 $\frac{1}{2}$ -ton, 6 x 6, amphibious.	Amph trk	31' 0"	8' 3"	25 or	2.2 to 4.5	50L 5W	240L 25W	2	7.5	1 105-mm howitzer.

Carrier, cargo, amphibious, design BARC.	BARC	62' 6 $\frac{3}{4}$ "	26' 7"	125 (normal) 200 (emerg)	53.6 (normal) 89.3 (emerg)	14L 7W	210L 105W	8	87	Heavy, bulky equipment.
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Note. No consideration need be made for the draft of amphibious vehicles. However, consideration must be given to the characteristics of the landing area which may affect beaching, such as mud, coral, or rock formations.

(e) *Characteristics of landing ships.*

Name	No. ships in class	Type	Op range (nautical miles)	Cargo capacity (ltons)	Troop cap ¹	Cargo space (sq ft)	Loaded draft		Length	Boat cap	Typical loads
							Beaching	Oceangoing			
LSD (1)-----	26	Flooded well deck.	13,000	1,233	252	17,316	27' (flooded)	18' (dry)	458'	2 LCVP and 1 LCPL	3 LCU, 4-5 med trk; 18 LCM (6), 30 lton cargo; 41 LVT; 27 LCVP; 47 DUKW; 44 M47 tk.
LSD (28)----	1	Flooded well deck.	13,000	2,410	362	19,800	30' (flooded)	19' (dry)	510'	3 LCVP and 1 LCPL	(With two temporary decks w/ramps) 92 LVT or 108 DUKW.
LST (1156)---	15	Ramp, 50-ton capacity.	6,000	Normal—446; Maximum landing—803; Full—1,395	395	14,000 (vehicles)	4' 11" fwd	8' 3" fwd	384'	3 LCVP and 1 LCPL	80 2½-ton trk, 450 lton cargo
LST (1153)---	2	Steam-driven; ramp, 50-ton capacity.	7,700	Normal—446; Maximum landing—803; Full—2,060	197	16,500 (cargo)	10' 8" aft	14' aft	382'	4 LCVP or 4 LCPR	144 ¾-ton trk, 415 lton cargo
LST (542)---	148	Ramp, 50-ton capacity.	19,000	Normal—446; Maximum beaching—803; Full—1,212	137	4,556 (vehicles)	3' 11" fwd	9' 6" fwd	328'	4 LCVP or 4 LCPR	233 ½-ton trk, 530 lton cargo
LST (542)---	148	Ramp, 50-ton capacity.	19,000	Normal—446; Maximum beaching—803; Full—1,212	137	4,556 (vehicles)	11' 11" aft	16' 3" aft	328'	4 LCVP or 4 LCPR	54 DUKW, 445 lton cargo ¹
LST (542)---	148	Ramp, 50-ton capacity.	19,000	Normal—446; Maximum beaching—803; Full—1,212	137	4,556 (vehicles)	5' 3" fwd	7' 2" fwd	328'	4 LCVP or 4 LCPR	226,000 gal gasoline
LST (542)---	148	Ramp, 50-ton capacity.	19,000	Normal—446; Maximum beaching—803; Full—1,212	137	4,556 (vehicles)	10' 2" aft	13' 0" aft	328'	4 LCVP or 4 LCPR	70,000 gal diesel fuel
LST (542)---	148	Ramp, 50-ton capacity.	19,000	Normal—446; Maximum beaching—803; Full—1,212	137	4,556 (vehicles)	3' 6" fwd	6' 4½" fwd	204'	4 LCVP or 4 LCPR	26 2½-ton trk, 650 lton cargo
LST (542)---	148	Ramp, 50-ton capacity.	19,000	Normal—446; Maximum beaching—803; Full—1,212	137	4,556 (vehicles)	7' 1" aft	8' 5" aft	204'	4 LCVP or 4 LCPR	46 ¾-ton trk, 675 lton cargo
LST (542)---	148	Ramp, 50-ton capacity.	19,000	Normal—446; Maximum beaching—803; Full—1,212	137	4,556 (vehicles)	3' 6" fwd	6' 4½" fwd	204'	4 LCVP or 4 LCPR	75 ¼-ton trk, 710 lton cargo
LST (542)---	148	Ramp, 50-ton capacity.	19,000	Normal—446; Maximum beaching—803; Full—1,212	137	4,556 (vehicles)	7' 1" aft	8' 5" aft	204'	4 LCVP or 4 LCPR	17 DUKW, 685 lton cargo ²
LST (542)---	148	Ramp, 50-ton capacity.	19,000	Normal—446; Maximum beaching—803; Full—1,212	137	4,556 (vehicles)	3' 6" fwd	6' 4½" fwd	204'	4 LCVP or 4 LCPR	3 M48 tanks
LST (542)---	148	Ramp, 50-ton capacity.	19,000	Normal—446; Maximum beaching—803; Full—1,212	137	4,556 (vehicles)	7' 1" aft	8' 5" aft	204'	4 LCVP or 4 LCPR	5 LVT
LST (542)---	148	Ramp, 50-ton capacity.	19,000	Normal—446; Maximum beaching—803; Full—1,212	137	4,556 (vehicles)	3' 6" fwd	6' 4½" fwd	204'	4 LCVP or 4 LCPR	9 DUKW
LST (542)---	148	Ramp, 50-ton capacity.	19,000	Normal—446; Maximum beaching—803; Full—1,212	137	4,556 (vehicles)	7' 1" aft	8' 5" aft	204'	4 LCVP or 4 LCPR	

¹ Troop capacity may be increased by berthing troops on decks. Troops must provide own feeding facilities.

² Also one LCU on launching ways and two 2 x 30 pontoon causeways or four 3 x 12 pontoon barges.

Note. 1. A boat space is the space weight allowed one soldier with his individual combat equipment. It is 224 pounds or 13.5 cubic feet. When computing boat spaces required for cargo, use either the weight or the space occupied, whichever is greater. Hand carts, loaded or empty, require two boat spaces.

Note 2. Running time may be computed from the

$$\text{formula } T = \frac{3D}{S}, \text{ when}$$

D = Distance run in hundreds of yards.

S = Speed in knots (1½ mph).

T = Running time in minutes.

(f) Characteristics of transport type vessels.

Name	No. ships in class	Class	Type	Length	Loaded draft	Troop capacity	Cargo capacity (ton)	Cargo space	Boat capacity	Cruising range (nautical miles)
Amphibious force flagship (AGC)-----	16	-----	C-2	459'	24'	-----	-----	-----	2 LCVP 4 LCPL 2 LCPR	30,000
Attack transport (APA 117)-----	57	Haskell	-----	455'	24'	1,565	446	13,000 sq ft 110,000 cu ft	2 LCM (6) 22 LCVP 1 LCPL 1 LCPR	9,800
Attack transport (APA 33)-----	6	Bayfield	-----	492'	27'	1,647	446	15,000 sq ft 160,000 cu ft	4 LCM (6) 18 LCVP 3 LCPL 2 LCPR	11,630
Attack cargo ship (AKA)-----	35	-----	C-2A	459'	24'	212	1,335-1,600	31,858 sq ft 291,706 cu ft	6 LCM (6) 14 LCVP 1 LCPL 1 LCPR 2 LCM (3)	12,000
High-speed transport (APD)-----	21	-----	EX-DDE	306'	13'	156	45	3,730 cu ft	2 LCVP 2 LCPR or 2 LCPL	5,100
Transport submarine (ASSP)-----	2	Sea Lion	-----	312'	-----	85	26.7	-----	20 rubber land- ing craft.	-----

(5) *Cargo movement by amphibious trucks.* Amphibious trucks are specialized equipment of exceptional value in amphibious operations which enable direct movement of cargo from ships to shore-based dumps. Experience indicates that amphibious trucks are capable of movement of 720 short tons per company per day for overall in-and-out of water operations. This factor may be used for general planning purposes.

(6) *Equipment required for operations on the beach, for beach clearance, and for operations in shore-based dumps.* World War II experience consistently showed a lack of sufficient shore-based equipment to receive cargo as rapidly as unloading from ships could be effected. Resulting bottlenecks at beaches and at beach dumps could have been avoided had additional cargo-handling equipment, particularly cranes, been available. It was found that cargo-handling equipment best adapted to beach and shore dump employment included cranes, tractors, and trucks. Detailed characteristics of these items are outlined below.

(a) Cranes should be self-propelled, of medium and heavy types, with booms 40 feet in length to permit lifting filled cargo nets. Each crane can handle discharge from 3 LUSs, or 8 LCMs, or 12 LCVPs under normal beach operations when sufficient trucks or tractors are available to haul or drag away unloaded cargo.

(b) Medium and heavy tractors, on an average, can tow two loaded sled pallets. This type movement from beach to dump is slow and less satisfactory than movement by truck. However, for dragging pallets from landing craft and within supply dumps, tractors are effective. Tractors are invaluable for clearing the beach and dump areas of mired vehicles. Eight to 10 tractors per assault division, 6 to 7 on beaches and 2 to 3 in supply dumps, are

usually sufficient. Several tractors assigned to a beach should be equipped with angledozers.

(c) See paragraphs 7.10 through 7.15 regarding trucks.

(7) *Beach service troops requirements.* Service troops are employed throughout the supply-service cycle from ship unloading to segregation and storage of supplies in shore-based dumps. The multiple functions performed in this cycle require both general and special service type units. Care must be exercised in balancing the type of troops employed, since a breakdown in service troops' functioning will render available equipment partially or completely ineffective.

b. *Logistical-Over-the-Shore (LOTS) Operations.*

(1) *General.* A LOTS operation provides, in situations other than amphibious operations, for the movement of cargo across the shore between ocean transportation and shoreside facilities. Beaches and other more difficult shoreline will be utilized during this type of operation to the extent required by the situation.

(2) *Beach capacity estimation.* The checklist contained in paragraph 7.6b(2) may be used to assist in determining the beach capacity. Certain of these factors are not primary considerations, and others must be greatly expanded according to the location under study, which will determine the weight to be given each individual factor. The following items must be investigated thoroughly to determine their effect on the operation:

(a) Weather—wind, fog, rainfall, temperature.

(b) Sea area—extent, depth of water, type bottom, vulnerability to sea wave action.

(c) Beach approaches — reefs, bars, manmade obstacles, tide, type of bottom, surf conditions, underwater gradient.

(d) Beach—gradient, composition, length, width, wave effect, exits.

(e) Hinterland — depth, concealment, transportation net capability.

(3) *Operating equipment.* The same materials handling functions are performed as in a conventional port situation (par. 7.6h), but there is a greater requirement for cranes, and forklift trucks must be able to traverse sand and soft terrain. Amphibians should be used to relieve congestion at the water's edge and eliminate unnecessary handling of cargo.

7.8. Inland Terminals

a. *Definition.* Inland terminals are defined as those inland transit points where cargo is—

(1) Temporarily held intransit awaiting disposition instructions.

(2) Transferred from one means of transportation to another.

(3) Broken down from bulk shipments and reshipped in small units.

(4) Collected from other points to make a transportation unit for reshipment.

b. *Capacity Estimation.* Inland terminal capacity is the total tonnage that can be *received*, *processed*, and *cleared* through the terminal in any one day. The terminal capacity is estimated by analyzing three major factors—reception capacity, loading and unloading or transfer capacity, and clearance capacity—to ascertain which is the limiting factor, and then determining its value as expressed in daily tonnage. The following is a checklist for estimation of inland terminal capacity:

Inland Terminal Capacity

<i>Collect these data when applicable</i>	<i>Compute these factors</i>	<i>Determine</i>
1. Channel depths.....		
2. Obstructions.....		
3. Capacity of rail facilities.....		
4. Capacity of highway facilities.....		
5. Capacity of pipeline facilities.....		
6. Capacity of air facilities.....		
7. Enemy air activity.....		
8. Enemy surface activity.....		
9. Climate.....		
10. Weather.....		
11. Contaminated areas.....		
12. Our own capabilities in combating obstacles.....		
1. Tactical dispersion requirements.....		
2. Wharf and/or platform facilities.....		
3. Discharge rates.....		
4. Unloading rates.....		
5. Loading rates.....		
6. Extent of destruction or contamination.....		
7. Climate and seasons.....		
8. Weather and tide characteristics.....		
9. Materials handling equipment available.....		
10. Cargo handling equipment available.....		
11. Floating craft and equipment available.....		
12. Airfield capabilities.....		
13. Transit sheds, yards, and areas.....		
14. Indigenous labor available.....		
15. Space reserved for local economy.....		
1. Capacity of rail facilities.....		
2. Capacity of highway facilities.....		
3. Capacity of inland waterway facilities.....		
4. Capacity of pipeline facilities.....		
5. Capacity of air facilities.....		
	(1) Evaluate to determine: A. Inland terminal reception capacity.	
	(2) Evaluate to determine: B. Loading and/or unloading or transfer capacity.	
	(3) Add to determine: C. Clearance capacity.	
		Inland terminal capacity.

c. *Estimation of Equipment.* Equipment requirements are determined by analyzing the projected workload of the inland terminal in relation to the tonnages and types of cargo to be unloaded, loaded, and transferred. See paragraph 7.6g and h for planning data on cargo handling equipment.

d. *Estimation of Personnel Requirements.* Personnel requirements are determined by evaluating the mission of the inland terminal in terms of workload, equipment to be manned, and services to be performed. To insure maximum efficiency in terminal operation, a balanced force of general service units and supervisory elements must be available. The use of indigenous and prisoner of war labor should be considered.

7.9. Air Terminals

a. *General.* Air terminals provide facilities for loading and unloading aircraft and for intransit handling of personnel and cargo which are moved by aircraft.

b. Responsibilities.

- (1) *Air Force.* Selection, preparation, and operation of air terminals, exclusive of airfields or landing areas operated by and for Army aviation and air transport units.
- (2) *Army.* Engineer service support of air terminals to include construction and maintenance other than R & U.

c. Operations.

- (1) *General.* The theater air force provides aerial port squadrons to operate air terminals. Theater army may establish facilities and station personnel at an air terminal in a tenant status to perform those functions agreed upon by the theater army and theater air commanders.
- (2) *Aerial port squadrons.* An aerial port squadron is a cellular type Air Force organization. Its utilization and its strength are determined by the assigned mission. These units provide passenger and cargo handling capabilities to include manifesting, warehousing, loading, unloading, tiedown, preparation for aerial delivery, and ejection in flight. One aerial port

squadron is capable of performing any one of the following tasks:

- (a) Handling 480 tons of cargo per 8-hour day in an air-landed operation.
 - (b) Rigging for delivery by parachute and loading 280 tons of cargo per 8-hour day when the packing of parachutes is not required.
 - (c) Rigging for delivery by parachute, packing parachutes, and loading 112 tons per 8-hour day.
- (3) *Army quartermaster aerial supply companies (TOE 10-407).* These units are stationed at selected air terminals or at Army logistical installations to prepare cargo for parachute or free-drop delivery. For capabilities of this company, see TOE 10-407.
 - (4) *Volume.* The volume of cargo and passenger traffic at an Army aviation air terminal may require assignment of a unit to perform these operations. Units which may be employed include the quartermaster aerial supply company or teams from TOE 10-500; transportation terminal service company (TOE 55-117); or terminal service teams from TOE 55-500.
- d. *Airfield Capabilities.*
- (1) The following criteria establish the maximum number of aircraft which can be based on an airfield or landing strip. Dispersion requirements may dictate decreased utilization of such facilities.
 - (a) Improved airfields in rear of combat zones can serve as a base for a maximum of 2 wings. Under ideal conditions, aircraft land or takeoff at 3-minute intervals, and 1 hour on the ground is required for each landing for necessary servicing, reloading, and inspection.
 - (b) Unimproved airfields and landing strips in rear of the combat zone can serve as a base for approximately one wing.
 - (c) Transport aircraft normally will not be based in the combat zone. On airfields in the combat zone, aircraft land or takeoff at 3-minute intervals under ideal conditions, and the time

required on the ground is reduced to 30 minutes. Service and maintenance is limited to emergency requirements only, and the tactical situation normally will not permit more time than that required for actual unloading and reloading.

- (2) For transport aircraft use, airfields in rear of the combat zone should be con-

sidered operational both day and night. Airfields in the combat zone may be operational only during daylight hours, depending on the enemy air capabilities.

- (3) The capabilities of air terminal operating units also influence traffic potential of airfields.

Section III. HIGHWAY TRANSPORT

7.10. Highway Transport Operations

a. Operations of motor transport in support of forces in a theater of operations are normally of the following types:

- (1) Port and beach clearance.
- (2) Interdepot or interterminal connecting operations.
- (3) Line haul services.
- (4) Intradepot or intrainstallation administrative support.
- (5) Direct support of tactical forces.

b. In evaluating specific types of motor hauls, the following terms are used:

- (1) *Local haul*—characterized by low running time in relation to loading and unloading time. These hauls normally involve a number of trips per day and are evaluated on the basis of tons moved during the operational period.
- (2) *Line haul*—characterized by high running time in relation to loading and unloading time. These hauls normally involve one trip or a portion of a trip per day and are evaluated on the basis of ton miles.
- (3) *Shuttle*—repeated trips made by the same vehicles between two specified points.
- (4) *Relay*—the moving of supplies or troops in a continuous forward movement without transfer of load. It is accomplished by change of truck-tractors and/or drivers.
- (5) *Highway movement*—a movement over a roadway. Higher than rated vehicle capacity loads are usually allowed on improved roadways.
- (6) *Off-road movement*—a movement off

hard-surface roadways, over open country or wooded trails, within the capabilities of the vehicles used.

7.11. Planning Factors

a. Because of the varied services performed, the different loads carried, and different terrain over which motor transport operations are conducted, planning factors should be used with caution and applied only in the absence of specific data on the local situation.

b. The following factors are used in highway transport planning for computing truck and truck company requirements in the absence of specific data:

- (1) *Vehicle availability*—the average number of task vehicles not in maintenance and therefore available for daily operations out of the total task vehicles assigned to a truck unit.
 - (a) Operational short range—83 percent.
 - (b) Long-range planning—75 percent.
- (2) *Vehicle payload*—the anticipated payload per vehicle (see table A below). Following are rules of thumb only:
 - (a) Off-road—rated capacity of vehicle.
 - (b) Highway—rated capacity plus 50 percent.
- (3) *Trips per day*—the daily round trips which a vehicle will average. These will vary with running time and loading and unloading time. Following are general averages only:
 - (a) Line haul—one per day.
 - (b) Local hauls—four per day.
- (4) *Length of haul*—the one-way distance cargo is to be hauled, from which round-trip mileage may be computed. Following are rules of thumb only:

- (a) Line haul—100 miles one way.
- (b) Local haul—15 miles one way.
- (5) *Rate of movement*—the average number of miles covered in an hour, including halts during the period of movement. For long-range planning, the following estimates may be used:
 - (a) Poor roads—10 miles in the hour.
 - (b) Good roads—15 miles in the hour.
- (6) *Operating turnaround*—the time, within total turnaround, consumed in loading, unloading, and movement. (See formula in par. 7.12.)
- (7) *Loading and unloading time*—time consumed per turnaround in loading and unloading areas, including time waiting, spotting, documenting, and handling of cargo on and off vehicles.
 - (a) *Straight trucks*—2.5 hours per round trip.
 - (b) *Semitrailers in relay operation*—1 hour per relay; 4 hours loading and unloading time per round trip.
 - (c) *Truck-tractors in relay operations*—1 hour per relay.
- (8) *Operational day*—the number of hours per day in which vehicles with drivers are normally employed.
 - (a) One shift (peacetime)—10 hours.
 - (b) Round-the-clock (wartime)—20 hours.
- (9) *Unit lift and daily lift*—unit lift is the amount of cargo a truck unit is expected to move at one time; daily lift is that which it can move in a day with a number of trips. (See table B, part I.)
- (10) *Ton miles and passenger miles*—the product of the number of tons or passengers and the actual mileage they were moved. (See table B, part II.)

Table A. Average Payload Capacities for General Planning

Type of equipment	Off-road	Highway average	Maximum	Men and equipment ¹
Truck, utility, ¼-ton, 4 x 4	¼ ton	.4 ton	.6 ton	2
Automobile, sedan, light				4
Truck, cargo, ¾-ton, 4 x 4	¾ ton	1 ton	1 ton	8
Truck, cargo, 2½-ton, 6 x 6	2½ ton	4 ton	5 ton	20
Truck, cargo, 5-ton, 6 x 6 (single tires)	5 ton	5 ton	7½ ton	20
Truck, cargo, 5-ton, 6 x 6 (dual tires)	5 ton	5 ton	10 ton	20
Semitrailer, cargo, 12-ton, 4-wheel	12 ton ²	12 ton	18 ton	³ 50
Semitrailer, van, 12-ton, 28-ft		12 ton	18 ton	
Semitrailer, gasoline tank, 12-ton, 4-wheel	3,000 gal ²	5,000 gal	5,000 gal	
Semitrailer, refrigerator, 7½-ton, 2-wheel, lightweight	6 ton ²	6 ton	7½ ton	
Semitrailer, transporter, 45-ton, 8-wheel, M15A2	40 ton ²	50 ton	50 ton	

¹ Does not include driver or assistant.

² Not generally used for this type of operation.

³ Recommended for emergency use only.

Table B. Truck Unit Capability Estimates for Long-Range Planning

I. Local haul—short tons per day (highway).

(Vehicle availability $\times$ average tons per vehicle $\times$ trips per day.)

Light truck company (2½-ton trucks)	$45 \times 4 \times 4 = 720$ ston/day
Light truck company (5-ton trucks)	$45 \times 6 \times 4 = 1,080$ ston/day
Medium truck company (semitrailer)	$45 \times 12 \times 4 = 2,160$ ston/day
Medium truck company (POL)	$45 \times 15 \times 4 = 2,700$ ston/day
Medium truck company (refrg 7½-ton)	$45 \times 6 \times 4 = 1,080$ ston/day
Heavy truck company	$18 \times 40 \times 4 = 2,880$ ston/day

II. Line haul—forward ton miles per day (highway).

(Vehicle availability $\times$ tons per vehicle $\times$ miles forward.)

Light truck company (2½-ton trucks)	$45 \times 4 \times 100 = 18,000$ TM/day
Light truck company (5-ton trucks)	$45 \times 6 \times 100 = 27,000$ TM/day
Medium truck company (semitrailer)	$45 \times 12 \times 100 = 54,000$ TM/day
Medium truck company (POL)	$45 \times 15 \times 100 = 67,500$ TM/day
Medium truck company (refrg 7½-ton)	$45 \times 6 \times 100 = 27,000$ TM/day
Heavy truck company	$18 \times 40 \times 100 = 72,000$ TM/day

7.12. Computing Truck Unit Requirements

a. The following formulas may be used for highway transport planning:

- (1) *One-lift hauls.* To determine the number of truck companies required to move a given number of tons in one lift, use the following formula:

$$\frac{\text{Tons to be lifted}}{\text{Tons per vehicle} \times \frac{\text{vehicle availability}}{\text{per company}}} = \text{truck companies required}$$

Example: To determine the number of transportation light truck companies required to move 2,700 short tons in 1 lift:

$$\begin{aligned} \text{When: } 2,700 &= \text{tons to be lifted} \\ 4 &= \text{tons per truck, } 2\frac{1}{2}\text{-ton, } 6 \times 6 \\ 45 &= \text{vehicles available per company} \\ \frac{2,700}{4 \times 45} &= 15 \text{ transportation light truck companies required} \end{aligned}$$

Note. If the number of vehicles required is desired rather than the number of truck companies, omit the vehicle availability factor in the formula.

- (2) *Sustained haul in one continuous operation.* In most operations, there is a continuous flow of supplies forward from dumps, depots, beaches, or ports. In such cases, tonnages move forward only, and trucks return for another load. The average turnaround time required by the truck units to complete

the round trip must be considered.

Hence, the formula applicable is:

$$\frac{\text{Daily forward tonnage} \times \text{turnaround time}}{\text{Tons per vehicle} \times \frac{\text{vehicles available}}{\text{per company}} \times \text{operating time/day}} = \text{truck companies required}$$

Example: To determine the number of transportation medium truck companies equipped with semitrailers, 12-ton, cargo, required to haul 5,000 short tons per day 180 miles forward from A to B, using the semitrailer relay method of operation.

$$\begin{aligned} \text{When: } 50 &= \text{tractor availability per company} \\ 12 &= \text{tons per semitrailer, and at least 2 semitrailers per tractor are available.} \\ 20 &= \text{hours operating time daily} \\ 1 &= \text{hours per relay in tractor operations} \\ 15 &= \text{miles in the hour} \end{aligned}$$

$$5,000 \times \frac{180 \times 2}{15} + (16) = \frac{12 \times 50 \times 20}{12 \times 50 \times 20} = 12.5 \text{ or } 13 \text{ medium truck companies}$$

¹ Relay time obtained as follows: There is one relay at each end of each segment of a relay movement.

- (a) The number of segments will depend upon the method of operation. If it is desired to have drivers complete a round trip over a single segment in one shift, the following method of determining the length of the segment may be used:

$$\begin{aligned} 10 \text{ hours} &= \text{normal shift} \\ 2 \text{ hours} &= \text{relay time per segment.} \\ 8 \text{ hours} &= \text{running time.} \end{aligned}$$

$$\frac{8 \text{ hours}}{2} = 4 \text{ hours forward running time.}$$

2

$$4 \times 15 \text{ (MPH)} = 60 \text{ miles forward.}$$

$$\frac{180}{60} = 3 \text{ segments required}$$

$$3 \times 2 \text{ (hours relay time per segment)} = 6 \text{ hours}$$

(b) As an alternate method in this situation, 1 relay point could be established at the end of 1 full shift of forward operation, giving 1 segment of 120 miles. The second shift would then accomplish the return movement over this segment. The segment of 60 miles could then be operated on a round trip per shift basis as outlined in (a) above. Any efficient combination of these methods may be used.

b. Similar formulas to those in *a* above can be used to compute requirements for troop movements or for hauling bulk liquid by using the number of persons or gallons, respectively, rather than short tons.

c. Through study and analysis of intelligence reports or the actual survey of road conditions in an area of operations, the highway planner may develop good reason for assuming that the planning factors as shown may be changed. He should, therefore, be in a position to alter his assumptions, computations, and the resulting requirements.

7.13. Truck Company Requirements

a. Having determined or assumed values for the factors in paragraph 7.12 above, the truck company requirements for any type of sustained operation may be estimated by use of the following formula:

$$\text{Companies required} = \frac{\text{daily tonnage} \times \text{operating turnaround}}{\text{payload} \times \text{availability} \times \text{operating day}}$$

In this formula, "operating turnaround" is computed as follows:

$$\text{Operating turnaround} = \frac{\text{round-trip mileage}}{\text{rate of march}} + \text{loading and unloading time}$$

(If the number of trucks is desired rather than

the number of truck companies, omit the "availability" factor in the basic formula.)

b. If it is desired to determine the number of truck companies required to move a given tonnage of cargo in one lift, the method of computation is:

$$\text{Companies required} = \frac{\text{total tonnage}}{\text{payload} \times \text{availability}}$$

(Again, if the number of trucks is desired rather than truck companies, omit the "availability" factor from the formula.)

c. Examples (using planning factors given in par. 7.11, including table A).

(1) Estimate the number of truck companies required for a 16-mile haul of 5,000 short tons of dry cargo daily, using 2½-ton, 6 x 6 trucks.

$$\text{Operating turnaround} = \frac{32}{10} + 2.5 = 5.7 \text{ hours}$$

$$\text{Requirements} = \frac{5,000 \times 5.7}{4 \times 45 \times 20} = 8 \text{ companies}$$

(2) Estimate the number of truck companies required to haul 3,000 short tons per day of dry cargo 180 miles, using 5-ton, 6 x 6 trucks, with 100 percent overload.

$$\text{Operating turnaround} = \frac{360}{10} + 2.5 = 38.5 \text{ hours}$$

$$\text{Requirements} = \frac{3,000 \times 38.5}{8 \times 45 \times 20} = 16 \text{ companies}$$

(3) Estimate the number of 2½-ton, 6 x 6 trucks required to haul 700 tons in 1 lift:

$$\text{Requirements} = \frac{700}{4} = 175 \text{ trucks}$$

(The above formulas may be used to compute requirements for hauling bulk liquid by substituting daily gallons for daily tonnage and payload in gallons rather than short tons.)

7.14. Vehicle Payload Capacities

1	2	3	4	5
Type of equipment	Off-road	Highway average	Maximum	Men and equipment ¹
Automobile, sedan, light				² 4
Bus, convertible, 37-passenger		5 ton	5 ton	37
Carrier, light weapons, infantry, ½-ton, 4 x 4	½ ton		½ ton	4
Semitrailer, stake, 6-ton, 22-ft	6 ton	8 ton	8 ton	³ 24
Semitrailer, van, 6-ton, 22-ft	6 ton	8 ton	8 ton	³ 24
Semitrailer, stake, 10-ton, 26-ft		8 ton	10 ton	³ 50
Semitrailer, van, 10-ton, 26-ft		8 ton	10 ton	³ 50
Semitrailer, low bed, 12-ton, 25-ft	12 ton	16 ton	18 ton	
Semitrailer, low bed, 12-ton, 40-ft	12 ton	16 ton	18 ton	
Semitrailer, cargo, 12-ton, 4-wheel	12 ton	12 ton	18 ton	³ 50
Semitrailer, van, 12-ton, 28-ft	12 ton	12 ton	18 ton	³ 50
Semitrailer, stake, 20-ton, 34-ft		18 ton	20 ton	³ 65
Semitrailer, van, 20-ton, 34-ft		18 ton	20 ton	³ 65
Semitrailer, low bed, 25-ton		20 ton	25 ton	
Semitrailer, low bed, 60-ton		50 ton	60 ton	
Semitrailer, refrigerator, 7½-ton, 2-wheel		6 ton	7½ ton	
Semitrailer, transporter, 45-ton, 8-wheel, M15A2	40 ton	40 ton	50 ton	
Trailer, amphibious, cargo, ¼-ton, 2-wheel	¼ ton		¾ ton	
Trailer, cargo, ¾-ton	¾ ton		1½ ton	
Trailer, cargo, 1½-ton	1½ ton		2¼ ton	
Truck, ambulance, frontline, ¼-ton, 4 x 4				² 4
Truck, ambulance, ¾-ton, 4 x 4				8
Truck, amphibious, 2½-ton, 6 x 6 (WW II)	2½ ton		4½ ton	25
Truck, cargo, ¾-ton, 4 x 4	¾ ton	1 ton	1½ ton	8
Truck, cargo, 2½-ton, 6 x 6	2½ ton	4 ton	5 ton	20
Truck, cargo, 5-ton, 6 x 6 (single tires)	5 ton	5 ton	7½ ton	20
Truck, cargo, 5-ton, 6 x 6 (dual tires)	5 ton	5 ton	10 ton	20
Truck, cargo, 10-ton, 6 x 6	10 ton	10 ton	15 ton	
Truck, dump, 2½-ton, 6 x 6, 9-ft	2½ ton	4 ton	4½ ton	12
Truck, dump, 2½-ton, 6 x 6, 11-ft	2½ ton	4 ton	5 ton	14
Truck, dump, 5-ton, 6 x 6	5 ton	10 ton	10 ton	
Truck, pickup, 1-ton, 4 x 4	¾ ton	1 ton	1½ ton	9
Truck, stake, 1½-ton, 4 x 2		1½ ton	2½ ton	
Truck, stake, 2½-ton, 4 x 2		2½ ton	3½ ton	
Truck, stake, 5-ton, 4 x 2		5 ton	7½ ton	³ 33
Truck, stake, 10-ton, 6 x 4		10 ton	12½ ton	³ 35
Truck, utility, ¼-ton, 4 x 4	¼ ton	.4 ton	.6 ton	2

¹ Based on 18 inches per man. Does not include driver or assistant.

² Less equipment.

³ Recommended for emergency use only.

7.15. Highway Tonnage Capabilities

a. In selecting the routes over which cargo is to be hauled, consideration must be given to the capabilities of the roads and bridges to sustain the operation. The gross weight of the heaviest loaded vehicle should not exceed the rated tonnage capacity of the weakest bridge, unless it is determined that such bridge(s) will be strengthened. It is difficult to determine the exact tonnage capabilities of highways for sustained operations because of the number of varying conditions which prevail. Also, the

volume of tactical, administrative, and indigenous traffic to be accommodated on supply routes may exceed the number of cargo-hauling vehicles, which further restricts the capabilities of highway transport.

b. The following table may be used as a guide in the absence of more accurate data for estimating the supply support tonnage capabilities of highways under varied conditions, assuming that operations are sustained, adequate road maintenance is provided, and each road bears two-way traffic. In using the table of re-

ductions, when more than one limiting feature is involved, apply the narrow roadway factor first, then to the new capability apply one of

the next three on terrain, and finally, to the latter adjustment, apply the weather factor if the conditions are for a sustained period.

	1	2	3	4	5	6	7	8	9
	Highway type	Daily tonnage forward			Reductions applicable to various conditions ¹				
		Optimum dispatch route only	Supply traffic communications zone	Supply traffic combat zone	Narrow roadway	Rolling terrain	Hilly with curves	Mountainous	Seasonal bad weather
		(short tons)	(short tons)	(short tons)					
2	Concrete.....	60,000	36,000	8,400	25%	10%	30%	60%	20%
3	Bituminous.....	45,000	27,000	7,300	25%	10%	30%	60%	30%
4	Bituminous treated.....	30,000	18,000	5,800	25%	20%	40%	65%	40%
5	Gravel.....	10,150	6,090	3,400	25%	20%	50%	70%	60%
6	Earth.....	4,900	2,940	1,600	25%	25%	60%	80%	90%

¹ Reduction factors are maximum under extreme conditions.

c. Planned tonnage movement should not exceed the capability of any portion of the road net to be used, unless reconstruction or heavy maintenance is provided to increase the capability of the section of highway or bridge to meet the demands. Otherwise, alternate routes must be selected to distribute the load. If no

alternate route is available and the indicated tonnage is not reduced, the highway or bridge can be expected to deteriorate rapidly and disrupt any sustained operation. (It should be kept in mind that maintenance vehicles and personnel on a road may also interfere with the flow of traffic and thereby limit capability.)

Section IV. PIPELINES

7.16. Capacity

The capacities of pipeline systems vary, depending on the size of pipe, gradient, location and size of pumps, and type of construction.

Welded commercial-type pipelines can be operated at much greater pressures than standard military victaulic-coupled lines. For planning purposes, the following capacities may be used:

Capacity of Standard Military Lightweight Steel Tubing

	1	2	3	4	5	6	7
	Inside diameter of line (in.)	Normal design capacity (bbl per hour)	Emergency capacity (bbl per hour)	Safe working pressure (psi)	Maximum working pressure (psi)	Gallons per day ¹	Net short tons per day
2	4-inch	355	393	600	750	298,000	910
3	6-inch	785	1,000	600	750	660,000	2,000
4	8-inch	1,355	1,730	450	600	1,140,000	3,480
5	12-inch	7,150	11,400	300	530	6,000,000	18,300

¹ Computed at normal design capacity, using an average operating day of 20 hours (average, all products).

7.17. Capability

Generally two 8-inch and one 6-inch pipelines or one 8-inch and three 6-inch pipelines are required (depending on the width of front) to maintain a 12-division slice plus air support.

For rapid planning of pipeline throughput capacities, the average daily consumption of 1 division plus 1½ air wings equals 760 short tons (6,025 barrels) per day. This requirement is divided approximately 55 percent Air Force and 45 percent Army.

Section V. RAILWAYS

7.18. General

Railway construction data are contained in chapter 8.

a. Estimates of railway capacity, operating personnel, equipment, and supply requirements for a specific railway line should take into consideration the basic characteristics of the line, the nature of the country in which the operation is planned, and the purpose for which the planning is being done. The following items are considered essential to intelligent appraisal. If these are not available, their effects upon the operation must be assumed, based on overall information of railroad operations within the country involved.

- (1) Length of line.
- (2) Condition of roadbed and track.
- (3) Gage of track.¹
- (4) Single, double, or multiple track.
- (5) Weight of rail.
- (6) Type of ballast and depth.
- (7) Type of ties (if wood, treated or untreated).
- (8) Tie spacing.
- (9) Axle load limitations (track and bridge).
- (10) Profile of line showing location and length of ruling grade.
- (11) Alinement of line showing location and length of minimum radius curves.
- (12) Location and description of bridges and tunnels.
- (13) Location and length of passing tracks.
- (14) Location, type, and quantity of fuel supply.
- (15) Location, quantity, and quality of water supply.
- (16) Location and capacity of yards.
- (17) (a) Location and capacity of car repair tracks and enginehouses.
(b) Location and capacity of heavy repair shops.
- (18) Type and availability of motive power.
 - (a) Weight in working order.
 - (b) Expected working tractive effort.
 - (c) Age.

¹ Track gages vary widely, starting at 1 foot 11½ inches and going to 5 feet 6 inches. The most widely used gages are—

Broad	Standard	Narrow
5 ft 6 in.-----	-----	3 ft 6 in.
5 ft 3 in.-----	4 ft 8½ in.-----	3 ft 3¾ in.
5 ft 0 in.-----	-----	3 ft 0 in.

- (19) Type and availability of rolling stock.
 - (a) Capacity and dimension.
 - (b) Age.
- (20) Allowable drawbar pull.
- (21) Diagrams showing minimum structure, maximum unrestricted loading, and equipment gages.
- (22) Signal system.
- (23) Dispatching facilities.
- (24) Route junctions.
- (25) Availability of new equipment and repair parts.
- (26) Indigenous labor resources.

b. A military railway operating division will vary from approximately 90 to 150 miles depending upon existing conditions. For general planning purposes, however, an average of 100 miles per railway division may be assumed.

7.19. Evaluation and Planning

Paragraphs 7.20 through 7.28 are designed primarily for wartime estimates of railway operations in a theater of operations. Analytical refinements and elaborate train density studies are difficult to justify and have been avoided because of the lack of basic information and the relative uncertainty inherent in military operations. The planner should also bear in mind that in the early stages of a war, indigenous equipment and labor may be utilized to a large extent, which again may vary the expected tonnage capacity.

7.20. Train Density

Train density is the number of trains per day which can be operated in each direction over a railway line. Work trains are not included in train density. Train densities will vary, depending upon the condition of track, location and length of passing sidings, adequacy of terminal facilities, and availability of motive power and rolling stock. Densities recommended below are averages based on experience under theater of operations conditions. After air superiority has been attained, the intensity of combat has been reduced, and dependent upon judgment of operating conditions, densities achieved may be expected to exceed by 20 percent those presented below. (For planning capacities, see par. 7.4.)

Single track lines¹-----10 trains per day in each direction.
 Double track lines-----30 trains per day in each direction.
 Multiple track lines-----The extra tracks will be used to rehabilitate and maintain two tracks in operation under most theater of operations conditions.

7.21. Net Trainload

The net trainload, or payload, carried by trains on different divisions of the same line may vary greatly, depending upon the conditions of operation. Experience indicates that, under normal theater of operations conditions over standard gage railways, a net trainload of 400 short tons may be used as an *average* for general planning purposes. On narrow gage railways, a net trainload of 300 short tons may be used.

7.22. Net Division Tonnage

a. Net division tonnage is the net tonnage (short tons) or payload which can be moved over a railway division each day.

Formula:

Net division tonnage = train density x average net trainload

b. Troop, hospital, or other special trains will replace an equal number of tonnage trains and, when operation of such trains is anticipated, the factor for train density must be so adjusted with the resulting decrease in net division tonnage.

7.23. Equipment Estimation

Planning data included herein are based on use of standard U. S. Transportation Corps equipment. Allowances for use of indigenous or captured equipment should be based on judgment after evaluation of the many factors involved, such as availability of equipment, extent of expected destruction, condition of equipment, types and local availability of fuel, availability of repair parts, types of coupling devices, etc. Data are available in logistical surveys, special transportation studies based on intelligence reports, reports of governments or railroads in peacetime, and from articles appearing in such publications as *Railway Gazette* (British) and *Railway Age* (United States).

a. *Road Engines*. The following data are recommended for general planning purposes.

¹Passing track intervals of 6 to 8 miles.

²Allows time for locomotive servicing, running repairs, and time lost between enginehouse and yards.

Computation of requirements should be made for each division separately.

Average rate of travel from division terminal to division terminal—8 miles per hour.

Time in each division terminal for steam locomotives—8 hours.²

Time in each division terminal for diesel-electric locomotives—3 hours.²

Reserve engines, to allow for unforeseen circumstances such as operational peaks, heavy repairs, or destruction—20 percent.

Formula:

$$\text{Number required for division} = TD \times \frac{RT + TT}{24} \times 2 \times RF,$$

when

TD = train density, one way.

RT = average running time in hours.

TT = terminal time at one end of the division.

24 = number of hours in a day.

RF = operational reserve factor = 1.20.

b. Switch Engines.

(1) Switch engine requirements at water and inland terminals and division terminals are dependent on the physical track layout and the number of cars required to be handled at such points. The following may be used as a general guide only:

Location	Requirements
Water and inland terminals	1 per 67 cars dispatched or received per day.
Division terminals-----	1 per 100 cars passing per day.

(2) Requirements as computed above should be increased by 20 percent to allow for unforeseen circumstances, repairs, etc.

c. Rolling Stock.

(1) Freight.

(a) Requirements are computed separately for operations between major

supply installations or areas on each line of communication as follows:

$$\text{Number of cars} = \frac{\text{daily tonnage}}{\text{average tons per car}} \times \text{turnaround time}$$

Turnaround time is the total estimated number of days required for a car from the time it is placed for loading at its point of origin, moved to its destination, unloaded, and returned to its point of origin. Such time may be computed as follows: allow 2 days at origin, 1 day at destination, and 2 days transit time for each division (or major portion thereof) which the cars must traverse. This method, rather than an actual hour basis, is used to incorporate delays due to terminal and way-station switching as well as in-transit rehandling of trains.

- (b) Computations should be increased by 10 percent to meet operational peaks, commitments for certain classes of cars, and bad order cars.

- (c) An average planning factor for net load per car may be assumed as follows:

<i>Standard gage to broad gage</i>	
US equipment	20 tons.
Foreign equipment	10 tons.

<i>Narrow gage</i>	
US equipment	15 tons.
Foreign equipment	7½ tons.

- (d) Tank car requirements are computed separately, based on the bulk POL requirement and the computed turnaround time.

(2) *Passenger.*

- (a) Passenger car requirements will vary, depending upon troop movement policies, evacuation policies, and rest and recuperation policies.
- (b) Theater passenger car requirements are normally fulfilled by acquisition of local equipment, with the exception of hospital cars or trains.

7.24. Characteristics of US Rolling Stock

Type of car	Gage	Capacity		Tare weight (empty tons)	Inside dimensions		
		Cubic feet	Tons		Length	Width	Height
I. Foreign Service							
Box (30-ton)-----	Narrow-----	1,588	30	13.6	34' 5½"	7' ¾"	6' 4"
Box (40-ton)-----	Std to broad-----	2,520	40	18.5	40' 6"	8' 6"	6' 5½"
Flat (30-ton)-----	Narrow-----	247 sq ft	30	10.9	34' 5⅞"	7' 2"	-----
Flat (40-ton)-----	Std to broad-----	351 sq ft	40	14.5	40' 9"	8' 7¼"	-----
Flat (80-ton)-----	Std to broad-----	447 sq ft	80	35.3	46' 4"	9' 8"	-----
Flat, depressed center (70-ton)-----	Std to broad-----	193 sq ft	70	41.5	50' 7"	9' 8"	-----
Gondola, high side (30-ton)-----	Narrow-----	946	30	13	34' 5"	6' 10½"	4' 0"
Gondola, high side (40-ton)-----	Std to broad-----	1,680	40	18	40' 0"	8' 3¾"	4' 0"
Gondola, low side (30-ton)-----	Narrow-----	356	30	12.1	34' 6"	6' 10½"	1' 6"
Gondola, low side (40-ton)-----	Std to broad-----	500	40	16	40' 4½"	8' ¾"	1' 6"
Tank, POL (6,000-gal)-----	Narrow-----	6,000 gal	20	16	-----	-----	-----
Tank, POL (10,000-gal)-----	Std to broad-----	10,000 gal	35	19	-----	-----	-----
II. Domestic Service							
Box (50-ton)-----	Std-----	3,975	50	23	40' 6"	9' 2"	11' 0"
Flat (50-ton)-----	Std-----	454 sq ft	50	25.5	43' 3"	10' 6"	-----
Flat (70-ton)-----	Std-----	513 sq ft	70	27	49' 11"	10' 3"	-----
Flat (100-ton)-----	Std-----	562 sq ft	100	35	54' 0"	10' 6¼"	-----
Gondola, high side (50-ton)-----	Std-----	1,770	50	25	41' 6"	9' 6"	4' 6"
Gondola, low side (50-ton)-----	Std-----	1,184	50	23	41' 6"	9' 6"	3' 0"
Tank, POL (10,000-gal)-----	Std-----	10,000 gal	50	23	-----	-----	-----

Note. Average payload for each type of car, except tank cars, is 50 percent.

7.25. Outsize Equipment

Outsize equipment is that equipment which, because of extreme dimensions (height, width, length) or extreme weight, or combinations of the foregoing, will require special handling under restricted speeds and/or on special cars. The planner should recognize the fact that more and more of this type of equipment is being designed and should attempt to build a train of these outsize loads for a single movement rather than assume a few in each train moving on the line of communication. Such movements require special meeting points on adjacent lines of a double-track line of communication and will retard traffic returning to its point of origin as well as following trains in the same direction.

7.26. Personnel Requirements

The basic unit of railway organization in a theater of operations, as in the United States, is the railway division. Military organizations of administrative and operating personnel are designed to fulfill the operating personnel needs of the basic units (railway divisions) and the administrative personnel needs of the several divisions comprising a system of railways. Personnel requirements are therefore estimated by division.

7.27. Supervisory, Operating, and Maintenance Organizations

a. Supervisory. The following organizations are supervisory:

- (1) *General headquarters, transportation railway service* (TOE 55-201). Normal requirement: 1 per 2 or more railway commands.
- (2) *Headquarters and headquarters company, transportation railway command* (TOE 55-302). Normal requirement: 1 per 2 railway groups.
- (3) *Headquarters and headquarters company, transportation railway group* (TOE 55-202). Normal requirement: 1 per 2 to 6 transportation railway operating battalions and 1 or 2 transportation railway shop battalions.

b. Operating. Transportation railway operating battalion (TOE 55-225).

- (1) Requirements are estimated on the basis of the number of traincrews re-

quired. The 50 traincrews provided in company A of the battalion are the controlling factor. When augmentation is necessary, additional crews are provided by TOE 55-500, transportation service organization. This augmentation does not upset the equilibrium of the battalion for carrying out its assigned function, provided the normal length of line to be operated is not exceeded or motive power added exceeding the capabilities of company B for equipment maintenance. Normally, 1 railway operating battalion is assigned to a civilian railway operating division (usually about 90-150 miles of roadway).

- (2) In estimating traincrew requirements, the following basis may be used:

- (a) *For road operations.* One crew per train per day (moving in either direction) per division.
- (b) *For switching.* Two crews per switch engine in operation. (For general planning purposes, reserve switch engines are not considered.)
- (c) *For road operations and switching.* Assume 80 percent availability of assigned crews to allow for sickness and other absences.

c. Maintenance.

- (1) *Transportation railway shop battalion* (TOE 55-235). Under normal requirements. 1 shop battalion may be expected to support 100 steam locomotives, 200 diesel-electric locomotives, and 2,500 cars; or perform depot maintenance monthly for 10 steam locomotives, 25 diesel-electric locomotives, and 600 cars. Exact requirements should be tempered by judgment and the overall railway plan for the theater.
- (2) *Railway workshop, mobile* (TOE 55-500). The railway workshop, mobile, may be required to provide back shop support in the initial phase of rail operations before the arrival of the shop battalion, or to perform repairs in forward areas to restore war-damaged equipment or to augment a

railway shop battalion in lieu of an additional shop battalion.

7.28. Supply

a. *Fuel and Lubricants.* (See pars. 5.13–5.23.)

Section VI. MOVEMENT OF TROOP UNITS BY RAIL

7.29. Space Requirements for Troop Loading on US Equipment

For planning purposes and staff training, the following assumptions may be used:

a. *Sleeping Cars, Average.* Twenty-six troops in US equipment (standard pullman) and 30 in tourist sleepers.

(1) Normally, all personnel will be moved in standard pullmans, two per section.

(2) In an emergency or during periods when there is a shortage of pullman equipment, it may be necessary to move personnel three per section. In this case, plans should be based on an average of 39 per standard pullman.

b. *Coaches, Average.* Fifty-five troops with individual equipment.

c. *Passenger Trains* (typical for long-distance moves). Thirteen sleeping cars, 2 kitchen cars, and 1 or 2 baggage cars—average 350 troops per train.

d. *Freight Trains.* For troop unit moves, including heavy equipment such as tanks, artillery, and engineer equipment, trains seldom exceed—

Infantry division—65 cars or 650 tons.

Armored divisions—55 cars or 1,200 tons.

e. *Mixed Trains.*

(1) Mixed trains which carry all the personnel with their vehicles, artillery, and equipment are desirable from a tactical and organizational standpoint. Such moves are not economical when passenger equipment is in short supply, since mixed trains move at freight speed, and equipment is not fully utilized.

(2) To maintain unit integrity (personnel and equipment), to include loading of

b. *Repair Parts.* Estimated repair parts requirements for motive power and rolling stock: 1.5 short tons per month for each train per day (moving in either direction) over each division.

all trailers with towing vehicles, will require 10 percent additional flatcars over those required for separate loading.

7.30. Loading of Organizational Equipment

a. The amount of headquarters, kitchen, and maintenance equipment varies somewhat in all units. For planning purposes, allow 20 short tons per company or equivalent unit.

b. Organizational equipment moves under applicable freight classification rules and rates dependent upon loading requirements. Checkable baggage up to 150 pounds on domestic moves and, normally, 350 pounds on moves to Army terminals will be carried free on the transportation tickets. When transportation groupings permit, checkable baggage for two companies or similar units may be loaded together.

7.31. Kitchen-Baggage and Flatcars

a. Kitchen-baggage and kitchen cars are furnished on the basis of 1 per 250 men or fraction thereof. Kitchen-baggage car requirements per train are dependent upon transportation groupings. For tentative estimates, allow one per unit.

b. Compute flatcars (or drop-end gondolas) required on basis of maximum utilization of each car, regardless of length. Do not restrict computation to cars of all one length. Twelve inches at one end of each car must be left for brake-wheel clearance. For detailed approved methods of loading vehicles and equipment, see Association of American Railroads booklet, "Rules Governing the Loading of Mechanized and Motorized Army Equipment"; also, "Major Caliber Guns for the United States Army and Navy, on Open Top Equipment."

7.32. Recommended Loading of Typical Vehicles and Equipment

	1	2	3
	Equipment	Rail car	Unit per car
1	Carrier, personnel, FT, armored, M59.	40' flat	2
2	Carrier, cargo, amph, M76-----	40' flat	2
3	Gun, SP, FT, twin, 40-mm, M42---	40' flat	2
4	Gun, SP, FT, 155-mm, M53-----	40' flat	2
5	Howitzer, 105-mm-----	40' flat	2
6	Howitzer, 155-mm-----	40' flat	1
7	Howitzer, SP, FT, 155-mm, M44, M44A1.	46' flat	2
8	Tank, light, M41A1, 76-mm gun, M32	50' 6" flat	2
9	Tank, medium, M48, 90-mm gun---	40' flat	1
10	Tank, heavy, M103, 120-mm gun, T123.	40' flat	1
11	Truck, cargo, ¾-ton, 4 x 4-----	50' 6" flat	3
12	Truck, cargo, 2½-ton, 6 x 6, LWB---	50' 6" flat	2
13	Truck, cargo, 5-ton, 6 x 6, LWB----	56' flat	2
14	Truck, dump, 2½-ton, 6 x 6, LWB, w/winch.	46' flat	2
15	Truck, gun lifting, heavy, 4 x 4, front, M249.	40' flat	1
16	Truck, med wrecker, 5-ton, 6 x 6, w/winch.	40' flat	1
17	Truck, tractor, 5-ton, 6 x 6, M52---	40' flat	2
18	Truck, trailer, tank transporter, 50-ton, M15A2.	40' flat	1
19	Truck, utility, ¼-ton, 4 x 4-----	50' 6" flat	8
20	Semitrailer, cargo, van, 6-ton, 2-wheel	50' 6" flat	2
21	Vehicle, tank recovery, M74-----	50' 6" flat	2

7.33. Infantry Division and Armored Division Rail Moves

The following tables show the amount of rail equipment needed to move infantry and armored divisions. The specific types of equipment to be used and the detailed makeup of each train must be worked out between the unit transportation officer and the installation transportation officer (CONUS movements) or the transportation officer of the area in which the movement originates (theater of operations movements).

a. *Infantry Division ROCID* (strength 13,748).

	TOE (ROCID)	Unit	Separate loading			Mixed trains		
			Sleepers ¹	Bag ²	Flat	Sleepers ³	Box ⁴	Flat
1	7-2T	HQ & HQ co, inf div-----	11	.5	13	8	.5	15
2	7-11T	BG (5)-----	(55)275	(3)15	(58)290	(37)185	(3)15	(62)310
3	17-65T	Armor bn, 90-mm-----	29	3	154	20	3	169
4	17-85T	Cav sq-----	26	2	74	17	2	82
5	5-15T	Engr bn-----	30	3	127	20	3	140
6	11-5T	Sig bn-----	20	1.5	76	14	1.5	78
7	6-100T	Div arty-----	68	1.5	208	45	1.5	222
8	7-62T	HQ & HQ det & band, inf div tn----	3	.5	4	2	.5	6
9	10-17T	QM co-----	8	.5	36	5	.5	40
10	8-15T	Med bn-----	12	1.5	22	8	1.5	23
11	9-25T	Ord bn-----	13	1	58	8	1	68
12	1-7T	Avn co-----	9	.5	51	⁵ 3	.5	⁶ 20
13	12-7T	Admin co-----	6	.5	6	4	.5	7
14	55-75T	Trans bn-----	21	2	129	14	2	155
		Total-----	531	33	1,238	353	33	1,335

Separate loading (40 passenger trains—average 13 S, 1 or 2 K, 1 or 2 B)⁷
(20 freight trains—average 60 cars).

Mixed trains (Number of trains dependent on car groupings).

See footnotes on page 370.

- ¹ 26 men per standard sleeper.
² 1 per 2 companies or similar units.
³ 39 men per standard sleeper.
⁴ Boxcars substituted for baggage cars.
⁵ Allowance made for personnel who will travel with aircraft.
⁶ Does not include aircraft.
⁷ S—Sleeper car.
B—Baggage car.
K—Kitchen car.

b. Armored Division ROCAD (strength 14,600).

	TOE (ROCAD)	Unit	Separate loading			Mixed trains		
			Sleepers ¹	Bag ²	Flat	Sleepers ³	Box ⁴	Flat
1	17-2T	HQ & HQ co, armd div.....	7	.5	19	5	.5	23
2	17-22T	HQ & HQ co, CC (3).....	(5) 15	(.5) 1.5	(13) 39	(4) 12	(.5) 1.5	(15) 45
3	11-55T	Sig bn.....	19	1.5	70	13	1.5	77
4	1-17T	Avn co.....	9	.5	53	⁵ 3	.5	⁶ 22
5	19-29T	MP co.....	6	.5	11	4	.5	13
6	17-45T	Cav sq.....	38	2.5	134	25	2.5	142
7	5-215T	Engr bn.....	39	3	167	26	3	186
8	7-25T	Armd inf bn (4).....	(39) 156	(2.5) 10	(89) 366	(24) 96	(2.5) 10	(97) 388
9	6-300T	Div arty.....	98	10.5	310	65	10.5	384
10	17-25T	Armor bn, 90-mm (4).....	(28) 112	(2.5) 10	(146) 584	(19) 76	(2.5) 10	(148) 592
11	17-62T	HQ & HQ det & band, armd div tn..	3	.5	5	2	.5	5
12	12-27T	Admin co.....	7	.5	7	5	.5	10
13	8-75T	Med bn.....	14	1.5	41	9	1.5	53
14	9-65T	Ord bn.....	23	2	118	16	2	141
15	10-45T	QM bn.....	16	1.5	135	11	1.5	140
		Total.....	562	47	2,059	368	47	2,221

Separate loading (44 passenger trains—average 13 S, 1 or 2 B, 1 or 2 K)⁷
(40 freight trains—average 50–55 cars).

Mixed trains (Number of trains dependent on car groupings).

- ¹ 26 men per standard sleeper.
² 1 per 2 companies or similar units.
³ 39 men per standard sleeper.
⁴ Boxcars substituted for baggage cars.
⁵ Allowance made for personnel who will travel with aircraft.
⁶ Does not include aircraft.
⁷ S—Sleeper car.
B—Baggage car.
K—Kitchen car.

7.34. Weight of Tracked Vehicles

The tracked vehicles of the divisions, with their towed loads, make up approximately the following tonnages:

Infantry division13,000 tons.
Armored division34,000 tons.

(In theaters of operation and for mixed trains in the United States, the crews and other troops which normally travel in or on the tracked vehicles usually will ride on the same train.)

7.35. Movement of Troop Units on Foreign Railways

a. The capacity of railroads and railway equipment fluctuates widely throughout the na-

tions of the world. Experience in Europe during World War II indicates that under the pressure of all-out war, there are few, if any, places in the world where complete troop units can be moved by rail at the same time that the rail net is supplying a major force. A compromise policy was developed in which tracked vehicles and foot troops were moved by rail whenever facilities were available and wheeled vehicles, with their normal towed loads, proceeded on highways.

b. *Assumed Capacity of Foreign Rail Facilities.*

(1) *Freight cars.*

War flats 50 tons.
Medium flatcars 25 tons.
Small flatcars 12 tons.
Boxcars 10 tons or 25 troops.

(2) *Passengers.*

Coaches¹ ----- 40 troops.
Sleeping cars¹ ----- 32 troops.

(3) *Trains (foreign).*

Maximum length --- 40 cars.
Maximum net load -- 400 tons.
Maximum troops ---- 1,000 (using boxcars).

7.36. Troop Movement Planning

a. Scales. In training and preparation for movement, all units will become familiar with the use of railway car loading scales, or equivalent scales, tables, or templates (par. 7.37).

b. Rail Movement Table. Tables are to be maintained by all units for movement by *all means* of transportation.

c. Types of Tables. When the rail movement has been ordered and the approximate types of equipment requested, the following tables must be prepared by each unit:

Train consist table (par. 7.39).

Entraining table (par. 7.40).

Individual train-loading plan (par. 7.41).

d. Alert Time—(zone of interior.) An alert is not an order, and rail carriers do not move equipment into position for loading on an alert. It requires 48 hours after receipt of orders by the Chief of Transportation to start loading a

¹In the forward areas, passenger equipment is seldom used for unit moves. The limited amount of available equipment may be used for movement of casualties, convalescents, redeployment groups, or leave trains.

division, assuming that no equipment is available at the installation.

e. Loading Time—(zone of interior.) Passenger trains require 1 hour for loading. Baggage cars for personal baggage and baggage cars used for kitchen purposes will be spotted in advance. The time required to load troop units with all vehicles and equipment on freight trains varies with the training status of the unit and the conditions at the loading point. Use 6 hours of planning.

7.37. Railway Car Loading Templates

In preparation of loading plans and determining flatcar requirements, car loading templates are helpful. The first step is to prepare templates to a suitable scale ($\frac{3}{8}$ " = 1 foot or $\frac{1}{2}$ " = 1 foot is recommended) for each item of equipment to be loaded. The transportation officer, or representative of the commercial carrier, can provide dimensions of the usable loading space of the various pieces of rolling stock which can be furnished. A diagram of the usable loading space is then drawn to the same scale as the equipment templates. By placing the templates over the usable loading space, the most economical car loading arrangements can be determined.

7.38. Rail Movement Table (Sample)

Infantry Division ROCID^{1 2 3 4}

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26		
TOE	Unit	Strength	Organiza- tional equipment	Checkable baggage	Vehicles and equipment per unit											Railway car requirements per unit												
					Standard vehicles						Special equipment	Passenger		Freight														
					Trailers			Trucks				Coach	Pullman	Box				Flatcars										
					Off & WO	EM	Pieces	Weight	Pieces	Weight		Trailer, cargo, ¼-ton 56"W 109"L	Trailer, cargo, ¾-ton 74"W 147"L	Trailer, cargo, 1½-ton 83"W 166"L	Truck, utility, ¼-ton, 4 x 4, 62"W 133"L	Truck, cargo, ¾-ton, 4 x 4, 64"W 189"L	Truck, cargo, 2½-ton, 6 x 6, M36, w/winch, 96"W 276"L	Items	Shipping length, inches	48 men	Std No. of sec (2 sec)	Tour No. of sec (3 sec)	Kitchen baggage	Organizational equipment	Checkable baggage	40'	42'	45'
					1	7-2T	HQ & HQ co, inf div																					
2	7-12T	Inf BG HQ & HQ co																										
3	7-17T	Inf BG rifle co																										
4	6-18T	Inf BG mortar btry, 4.2"																										
5	17-66T	Armor bn, HQ & HQ co																										
6	17-67T	Med tk co, 90-mm																										
7	17-86T	Cav sq, HQ & HQ trp																										
8	17-87T	Cav sq, recon trp																										
9	5-16T	Engr bn, HQ & HQ co																										
10	5-17T	Engr co																										
11	11-6T	Sig bn, HQ & HQ co																										
12	11-7T	Sig bn, comd op co																										
13	11-8T	Sig bn, fwd comm co																										
14	6-101T	Div arty, HQ & HQ btry																										
15	6-126T	FA how bn, 105-mm, towed, HQ & HQ btry.																										
16	6-129T	FA how bn, 105-mm, towed, svc btry.																										
17	6-127T	FA how btry, 105-mm, towed																										
18	6-146T	FA comp bn, HQ & HQ btry																										
19	6-149T	FA comp bn, svc btry																										
20	6-148T	FA how btry, 8-in., towed																										
21	6-147T	FA how btry, 155-mm, towed																										
22	6-150T	FA msl btry, 762-mm rkt, SP																										

² This tentative table should be maintained currently by division transportation officers in compliance with paragraph 12, AR 55-130. Subordinate and separate units should maintain similar tables.

⁴ Organizational equipment and checkable baggage must be listed separately.

Division

Note 1. Upon receipt of movement order, commanding general will designate the order in which units will be forwarded.

Note 2. Train consist table is prepared by division transportation officer from data appearing on revised rail movement table.

Note 3. Maximum and minimum length of trains (total number of freight and passenger cars) will be prescribed by the origin railroad.

Note 4. Under "transportation groupings" show units which will comprise each individual train.

Note 5. Under "train officers" show by name the officers assigned to each train.

Division

[illegible]

Note 1. Upon completion of train consist table and individual train loading plan, division transportation officer will prepare this entraining table.

Note 2. "Train number" will be as shown on train consist table.

Note 3. In the zone of interior, the "main number," which authorizes the movement of each train, will be issued by the Military Transportation Section, Association of American Railroads, through the Passenger Division Military Traffic Management Agency, Washington, D. C., to the local transportation officer, who will furnish main number to division transportation officer. In theaters of operation, the main number normally will be issued by the communications zone transportation officer.

Note 4. Entraining officers will be designated by name.

7.41. Individual Train-Loading Plan

Division

Train No. _____ Main No. _____

Assignment of Personnel and Equipment to Individual Railway Cars

Front

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	Continue to last car				rear

Suggested Symbols for Equipment and Vehicles

Equipment	Symbol	Equipment	Symbol	Equipment	Symbol	Equipment	Symbol
Coach	CH	Box	BX	Howitzer, 105-mm	HL		
Pullman, standard	SP	Truck, ¼-ton	TJ	Howitzer, 155-mm	HM		
Pullman, tourist	TP	Trailer, ¼-ton	TQ				
Troop sleeper	TS	Truck, 2½-ton	TC				
Kitchen car	K	Motorcycle	MC				
Kitchen-baggage	KB						

Assignment of Units to Cars (By Block Numbers Above)

Unit	Block No.	Unit	Block No.	Unit	Block No.

Note 1. This plan is prepared by the division transportation officer. Copies should be furnished to—

- Troop commanders.
- Entraining officers.
- Officer in charge of troops (train).
- Motor park dispatcher so that vehicles will arrive at entraining point in the order in which they will be loaded on railway cars.
- Local transportation officer.

Note 2. In each block, indicate by symbol the specific personnel and equipment assigned to each car.

Note 3. In each block representing an open-top freight car (flatcar or gondola car), indicate by symbol the equipment specifically assigned to each car.

Note 4. In the space provided at the bottom of the plan, all cars (freight and passenger) should be assigned by block numbers (not by railroad car initials and numbers) to the specific units which will occupy them.

Section VII. AIR TRANSPORTATION

7.42. General

a. The movement of troops by air transportation provided by the Air Force is normally ordered by the headquarters in command of both the transported and transporting units. These orders are issued simultaneously to the commander of the unit to be transported and to the commander of the transporting unit.

b. Troop movements by air are of two types: tactical and administrative. When the move is tactical, the loading plans will depend upon the tactical mission to be accomplished at the end of the move. An administrative move is merely a ferrying operation from one base to another. It is not feasible to prescribe standard tactical loads for the air transport of personnel and equipment because of the variable conditions surrounding each operation. For example, the loading plans will vary depending upon the mission, the aircraft available, the distance to be flown, the conditions of the flight, the security of the landing area, the time available for disassembly and assembly of equipment, the amount of supplies to be transported with the troops, the size of engineer tools needed in the terrain to be encountered, and other factors. For more technical data on the loading of transport aircraft, see TM 57-210.

c. The air movement of a large body of troops normally will involve concurrent departures from several airfields and, in the objective area, concurrent landings at several terminal landing strips. The availability of transport aircraft and base facilities, the urgency of the situation, and the likelihood of hostile interference will be major factors which determine the number of installations employed, as well as the number of sorties to be made by the transporting aircraft. For considerations governing the employment of air transportation, see FM 100-5. For staff procedures, air movement tables, and other forms relative to air movements, see TT 57-100-30 and TM 57-210.

7.43. Air Movement of Supplies

a. *General.* Supplies may be air-landed in powered aircraft, landed by parachute in standard containers or by heavy drop, or they may be delivered by the free-fall method.

b. *Air Landed.*

- (1) When using aircraft for air-landing bulk supplies, the allowable cargo load to be carried will be determined by the radius or range to be flown. The allowable cargo loads of aircraft operating under *radius conditions* can be determined from the graphs in paragraph 7.45.
- (2) To determine the aircraft requirements, the following formula may be used (airplanes—all types):

$$y = \frac{b}{x}, \text{ when}$$

y = number of aircraft required.

b = weight of supplies in pounds to be landed.

x = allowable cargo load of airplane in pounds for radius or range used.

Example. To determine C-119 aircraft requirements for air-landing of 600 tons of supplies to be moved 500 miles under radius conditions.

1. Allowable cargo load for 500 miles under radius conditions is determined to be 17,000 pounds.

2. Total weight of supplies $600 \times 2,000 = 1,200,000$ pounds.

$$3. y = \frac{1,200,000}{17,000} = 70.6 \text{ or } 71$$

C-119s.

c. *Parachute.*

- (1) The amount of supplies to be delivered by parachute from the various types aircraft is dependent on the number and types of containers that can be carried and the container ejection means that can be employed. See paragraph 7.45 for aerial delivery characteristics of the various aircraft.
- (2) To determine aircraft requirements for the delivery of parachute supplies, the same basic formula used for air-landed supplies may be used:

$$y = \frac{b}{x}$$

The value of x can be determined from the graphs for the type aircraft given in paragraph 7.45.

7.44. Army Aircraft

a. General. Army aircraft, both fixed and rotary wing, are employed to move cargo, personnel, and equipment within the combat zone. Performance standards are affected by many variables: range, altitude, temperature, humidity, existing weather, individual aircraft characteristics, and aviator proficiency. The weight-lifting capabilities of all aircraft are particularly dependent on air density or density alti-

tude, which is composed of the three variables: altitude, temperature, and humidity. As air density decreases, lift capability decreases. Normally, wind will not materially affect operations. However, in operations requiring long ranges or maximum lift capabilities, wind may become a critical factor. The computations for the detailed lift capabilities of Army aircraft to support specific operations must be performed by technically qualified personnel.

b. Army Aircraft Characteristics.¹

1	2	3	4	5	6	7	8	9	10	11	12	13
	Unit	H-13G (Sioux)	H-19D (Chickasaw)	H-21C (Shawnee)	H-23C (Raven)	H-34A (Choctaw)	H-37A (Mojave)	H-40 ² (Iroquois)	L-19E (Bird Dog)	L-20B (Beaver)	L-23D (Seminole)	U-1A (Otter)
a. Crew ³ (recommended)-----		1	1	3 2	1	3 2	3 3	3 2	1	1	1	3 2
b. Dimensions:												
(1) Length—fuselage-----		31'5"	41'4"	52'6"	28'2"	46'9"	64'11"	40'4"	25'10"	30'5"	31'6"	41'10"
(2) Length—blades unfolded-----		41'5"	62'3"	86'4"	40'6"	65'10"	88'	-----	N/A	N/A	N/A	N/A
(3) Length—blades folded-----		N/A	42'6"	52'7"	N/A	37'	55'8"	-----	N/A	N/A	N/A	N/A
(4) Width—blades folded-----		N/A	11'7"	14'	N/A	13'	27'4"	-----	N/A	N/A	N/A	N/A
(5) Width—tread-----		7'6"	11'	13'4"	7'6"	12'	19'9"	8'1"	7'6"	10'2"	13'4"	11'2"
(6) Height—extreme-----		9'6"	15'3"	15'9"	9'10"	15'10"	22'4"	14'7"	9'2"	10'5"	11'6"	13'
(7) Diameter—main rotor-----		35'1"	53'	44' ea	35'	56'	72'	44'	N/A	N/A	N/A	N/A
(8) Diameter—tail rotor-----		5'8"	8'9"	N/A	5'6"	9'4"	15'	-----	N/A	N/A	N/A	N/A
(9) Wing span-----		N/A	N/A	N/A	N/A	N/A	N/A	N/A	36'	48'	45'3"	58'
c. Cargo door:												
(1) Dimensions—width/height-----		N/A	4'4'	Rescue— 3'1" /4'11" Cargo— 3'9"/ 4'11"	N/A	4'4"/4'	Right— 5'10"/6' Bottom hatch— 6'/4'	4'/3'10"	3'9"/2'9"	3'4"/3'4"	2'6"/2'6"	Right— 2'6"/3'9" Left 3'10" 3'9"
(2) Location—side of fuselage-----		N/A	Right	Rescue— right Cargo— left	N/A	Right	Nose—not aval/6' 10"	Both	Right	Right and left	Right	
d. Cargo compartment:												
(1) Height of floor above ground-----		N/A	2'2"	4'	N/A	34"	Right— 2'11" Nose— N/A 30'4"	1'10"	2'8"	3'8"	4'2"	4'
(2) Length-----		N/A	10'	20'	N/A	11'		3'9"	N/A	9'	{ Fwd—393 lb. (including weight of radios) Aft—300 lb. }	12'8"
(3) Width-----		N/A	5'	5'8"	N/A	5'6"	7'8"	7'8"	N/A	4'		5'
(4) Height-----		N/A	6'	5'6"	N/A	6'	6'8"	4'8"	N/A	4'3"		5'
(5) Cargo space—cube-----	cu ft	N/A	300	615	N/A	363	1,252.3	120	N/A	4125	-----	286
(6) Payload ⁵ -----	lb						MUST COMPUTE—SEE (5) BELOW					
e. External cargo ⁶ :												
(1) Max cargo sling capacity-----	lb	N/A	2,000	4,500	N/A	4,000	10,000	-----	250 (ea wing)	500 (ea wing)	N/A	N/A
(2) Rescue hoist capacity-----	lb	N/A	400	400	N/A	N/A	2,000	-----	N/A	N/A	-----	-----

<i>f. Passenger capacity:</i> ^{5 7}												
(1) Troops ⁸ —seats available-----		1	10	20	2	12	23	2-3	1	5	5	9
(2) Litters-----		⁹ 2	6	12	¹⁰ 2	8	24	2	1 ambu- latory	2 litter + 2 ambu- latory	0	4 litter + 4 ambu- latory
<i>g. Operating characteristics:</i>												
(1) Cruise speed with payload-----	K	68	1180	1186	60	1290	70	100	100	122	158	125
(2) Maximum allowable speed-----	K	78	115	110	73	150	130	132	190	173	234	168
(3) Maximum range (ferry)-----	NM	161	336	476	104	513	310	435	540	833	1,359	980
(4) Grade of fuel ¹³ -----		91/96	91/96	100/130	91/96	100/130	115/145	91/96	80	91/96	100/130	91/96
(5) Fuel consumption per hour—cruise speed ¹⁴ -----	lb	87.6	340	620	73	673	1,235	271	51	138	156	195
(6) Maximum usable fuel capacity---	lb	245.4wo / litters	¹⁵ 918	¹⁶ 3,300	159	1,554	¹⁶ 5,172	813	246	¹⁶ 888	1,380	1,296
		213.6 w/ litters										
(7) Maximum allowable gross weight--	lb	2,350	7,900	¹⁷ 13,500	2,500	13,300	31,000	5,619	2,400	4,820	7,000	8,000
(8) Basic operational weight ⁸ -----	lb	1,536	5,650	9,500	1,725	7,900	20,860	4,224	1,812	3,447	5,165	4,481

¹ Slight variations between individual aircraft may be encountered.

² Information on H-40 is approximate and does not necessarily reflect data of production models to be accepted by the Department of the Army.

³ Includes basic aircraft weight, pilot, oil, trapped fuel. Does not include usable fuel. When crew is more than 1, each individual crew member over 1 is computed at 200 pounds each.

⁴ Aft of pilot.

⁵ Payload = maximum allowable gross weight (line *g*(7))—basic operational weight (line *g*(8)).
Fuel required = distance (NM) + cruise speed (line *g*(1)) × fuel consumed per hour (line *g*(5)).

⁶ Maximum external payload is limited to maximum cargo sling capacity, maximum allowable gross weight, or the computed gross weight for hovering out of ground effect, whichever is lower.

⁷ Limited to payload.

⁸ Troops are computed at 240 pounds per individual.

⁹ Cargo may be carried on litter racks in lieu of patients.

¹⁰ A maximum of 220 pounds may be carried on each litter when both are used. Maximum unsymmetrical loading is 160 pounds in left litter, with pilot in center seat.

¹¹ Use 70K with external load.

¹² No information available for flight with external loads.

¹³ All Army aviation fuel is MIL-F5572.

¹⁴ 5,000-foot altitude—maximum gross weight—standard atmosphere—no wind. Does not include warmup or reserve fuel requirements.

¹⁵ Self-sealing tanks.

¹⁶ With auxiliary tanks. *Note.* On H-21C and H-37A, these 230-gallon tanks may be replaced with 300-gallon tanks and are jettisonable.

¹⁷ This is maximum gross weight, pending completion of qualification tests. If approved, this will be increased to 15,061 pounds.

Note. Performance data based on NACA standard atmospheric conditions. (29.92" Hg-59° F.-0 mph wind.)

Payloads must be reduced for each additional 20 miles of operating radius as follows (approximate):

H-19—10 percent	H-34—5 percent
H-21— 9 percent	H-37—5 percent

Payloads may be increased/decreased because of variations in density, altitude, and wind velocity. The Army aviation staff officer should be consulted for accurate, detailed computations to meet specific requirements.

c. Rotary-Wing Aircraft.

(1) *General.* Army rotary-wing aircraft (helicopters) are limited in speed and range as compared with fixed-wing aircraft. However, their ability to land and take off vertically permits the delivery of personnel and materiel to and the evacuation from areas of operations in accessible to fixed-wing aircraft. Likewise, their capability for flight at relatively slow speeds permits continued operations under weather conditions of low ceiling and restricted visibility.

(2) *Planning factors (rotary-wing).*

(a) *Availability.* The number of helicopters available for a mission at any one time will depend upon the status of maintenance and inspections on the helicopters in the unit. Experience indicates that about two-thirds (67 percent) of the helicopters assigned to a unit are available for flying during continuous operations. On a mission of short duration (less than 6 days), approximately 90 percent of assigned aircraft will be operational.

(b) *Cargo.* The dimensions of packages are restricted only by the size of the cargo compartment doors and/or the system used to carry the cargo externally—assuming, of course, that the weight of the pack-

age(s) does not exceed the weight limitations for the aircraft under prevailing conditions. Typical items of cargo for internal loading are boxes of rations, ammunition, signal equipment, vehicle and aircraft parts, and supplies. Loads too large to fit into the cargo compartment but under the maximum weight permissible for external loads may be carried slung under the helicopter to expedite loading and unloading.

(c) *Landing facilities.* Provision must be made for adequate landing sites when planning helicopter movements. The minimum requirements for landing sites are as follows. However, larger areas with cleared approaches are highly desirable to improve safety margins of operation.

H-13, H-23	20 yards × 20 yards
H-19, H-40	30 yards × 30 yards
H-21, H-34	30 yards × 50 yards
H-37	50 yards × 70 yards

(d) *Maintenance.* Maintenance facilities should be provided at all base landing sites, the minimum requirement being a sheltered area which will provide adequate shelter for organizational maintenance on the helicopters. For planning purposes, 16 maintenance man-hours per flying hour may be considered average for the H-19, 17 hours for the H-21 and H-34, and 25 hours for the H-37.

(e) *Hours of operation.* The average number of hours of operation per day for continuous operations should not exceed 4 hours per helicopter.

(f) *Loading or unloading time.*

Personnel:

Troops	3 minutes
Casualties	10 minutes

Cargo:

Internal in fuselage	5 minutes
Suspended beneath helicopter	30 seconds

(g) *Payload guidance.*

	1	2	3	4	5
	Per aircraft ¹				
	Aircraft per company	Fully equipped troops ²	Recommended payload (tons)	Litter patients	Average cruising speed
H-19D	4 to 8	7	0.9	6	80K
H-21C	20	12	1.4	12	85K
H-34A	20	19	2.2	8	90K
H-37A	16	33	3.5	24	70K

¹ Based on 1 crewman in H-19D; 2 crewmen in H-21C and H-34A; 3 crewmen in H-37A.

² Computed at 240 pounds per individual.

These figures are applicable for operations conducted at a 50-nautical mile radius. Further reduction in payload may be expected for temperatures above 70° F., at higher altitudes, and as operating radius increases. This payload reduction approximates 10 percent for each additional 20 miles of operating radius for the H-19, 9 percent for the H-21, 5 percent for the H-34, and 5 percent for the H-37.

(h) *Determination of transport helicopter requirements.*

1. Most helicopter operations will be of the short-haul type and may require that more than one round trip (sortie) be flown in support of the movement.
2. To determine the number of helicopters or units required to accomplish a given mission or the capabilities of helicopters on a specific mission, the staff planner should use the following formulas:

$$N = \frac{HS}{D}, \text{ when}$$

N = Number of round trips (sorties per aircraft per day). This figure must be the resultant next lower whole number if a fraction

¹ If service and fuel are available at both pickup and delivery points, one-half sortie can be computed as a lift. (A lift is the movement of a load from origin to destination.) This would require the helicopters to remain in the delivery point area for service, which is normally undesirable.

is involved; a sortie must complete a round trip.¹

S = Average sortie speed of aircraft in knots. For planning purposes, use cruising speed unless some other speed is specified.

D = Round trip distance in miles. This distance must be the actual distance flown rather than airline distance from origin to destination. If airline distance is used, add 15 percent to the airline distance to obtain estimated flight distance.

H = Represents the number of operational hours available.

$$O = \frac{T}{N \times P}, \text{ when}$$

O = Number of operational aircraft required or available daily.

T = Tonnage to be moved or tonnage that can be moved.

P = Payload of type aircraft used.

$$A = 1.5 \times O, \text{ when}$$

A = The number of aircraft required or available to carry out a sustained operation. (This formula applies the daily availability factor of 67 percent to O to obtain A or to A to obtain O.)

3. This method of determining helicopter requirements is particularly applicable to movement of supplies or troops when combat loading is not a factor to be considered. Aircraft for air-landed assault operations should be determined by the preparation of a planning worksheet. The planning worksheet develops loads to provide for tactical integrity of the combat units and combat loading of each aircraft. The method of determining aircraft require-

ments described herein can be used to *estimate* requirements for assault operations by adding 10 percent to the unit personnel and equipment tonnage to allow for combat loading.

4. **Examples.** A division has been allocated 18 H-21 helicopters for a period of 3 days to assist in moving supplies from the army supply points to the division distributing points. The round trip actual flight distance is 80 nautical miles. The division G4 desires to know what the daily lift capacity of this helicopter company will be for this mission.

Solve first for N (number of sorties per aircraft per day):

$$N = \frac{HS}{D}, N = \frac{4 \times 86}{80}, N = 4.3 \text{ or } 4 \text{ sorties per day:}$$

day:

Solve next for O (number of operational aircraft available):

$O = 90 \text{ percent of } A(18), O = 16 \text{ operational aircraft per day.}$

Solve for T (daily tonnage capability of available aircraft):

$$O = \frac{T}{N \times P}, 16 = \frac{T}{4 \times 1.4}, T = 89.6 \text{ short tons}$$

per day.

The army G4 has a requirement to move 300 short tons of cargo per day from the army service area to the 20th Inf Div. Because of terrain and enemy action, this movement cannot be made by surface means. The G4 is computing the number of H-21s that will be required to accomplish this mission. The estimated flight distance from the army service area to the 20th Inf Div distributing points is 28 nautical miles.

$P = 1.4 \text{ short tons.}$

$T = 300 \text{ short tons.}$

$S = 86K.$

$D = 56 \text{ nautical miles (round-trip distance).}$

$$N = \frac{4 \times 86}{56}, N = 6.14, N = 6 \text{ (sorties per aircraft).}$$

$$O = \frac{300}{6 \times 1.4}, O = 35.7 \text{ or } 36 \text{ (helicopters).}$$

$A = 1.5 \times 36, A = 54 \text{ helicopters or approximately 3 companies of H-21 helicopters.}$

d. *Fixed-Wing aircraft.*

- (1) *General.* Army fixed-wing aircraft are limited in speed and range as compared with larger transport type aircraft. The ability of Army fixed-wing aircraft to land and take off from selected small, unprepared areas permits the delivery of personnel and materiel to and the evacuation from areas of operations inaccessible to larger aircraft. The ability of Army fixed-wing aircraft to fly slowly and maintain a high degree of maneuverability further enhances their value in forward areas under combat conditions.

- (2) *Planning factors (fixed-wing).*

- (a) *Availability.* The operation plan should be based on the availability of 75 percent of the assigned aircraft for sustained operations. A higher availability ratio of approximately 95 percent may be obtained for operations of short duration (less than 6 days). This higher availability ratio will depend upon the status of maintenance and inspections, repair parts, time available for maintenance, and degree of skill of maintenance personnel.

- (b) *Cargo.* Cargo may be delivered by three means: free fall, parachute, or air landed. The type of delivery utilized is normally requested by the receiving unit. The size and amount of cargo which may be loaded internally will be governed by the following:

1. Size of compartment door.
2. Compartment door location with respect to the cargo compartment.
3. Size of cargo compartment.
4. Lifting capability of the aircraft used.

- (c) *Landing facilities.* The development of a landing site is a continuous operation. Provisions must be made for an adequate site when planning aircraft movements. The minimum requirements for landing sites are as follows:

Aircraft at maximum gross weight	No-wind condition at sea level over 50-foot obstacle	
	Length	Width
L-19	700 ft	50 ft
L-20	1,000 ft	60 ft
L-23	1,800 ft	60 ft
U-1A	1,500 ft	90 ft

(d) *Maintenance.* Under normal climatic conditions, no extensive facilities are required for organizational maintenance. Special equipment and facilities will be required when operating in extreme climatic conditions. Direct support field maintenance units are equipped for field operations under normal climatic conditions. Special considerations for equipment and facilities will be required under extreme conditions. For man-hour requirements for aircraft maintenance, applicable publications should be consulted.

(e) *Hours of operation.* Based on a sustained operation, 6 hours' flying time per day per available airplane should be used as a planning factor.

(f) *Loading time.*

Personnel:

Troops—approximately 2 to 3 minutes (dependent on type aircraft).

Casualties—10 minutes.

Cargo:

Internal in fuselage—dependent on type cargo, 10 to 30 minutes.

External beneath wings of airplane—approximately 10 minutes.

(g) *Unloading time.*

Personnel:

Troops—1 minute.

Casualties—10 minutes.

Cargo:

Internal in fuselage—approximately 5 minutes.

External — air-landed — 10 minutes.

Parachute—30 seconds.

Free-fall—10 seconds.

(h) *Payload guidance.*

	1	2	3	4	5
	Per aircraft ¹				
	Aircraft per company	Fully equipped troops ²	Recommended payload (tons)	Litter patients	Average cruising speed
U-1A	16	13	1.5	4	125K

¹ Based on 50-nautical mile radius of action.

² Computed at 240 pounds per individual.

(i) *Determination of aircraft requirements.* See c(2)(h) above.

7.45. Air Force Transport Aircraft

a. *General.* The data in this paragraph are designed to present for use by division, corps, and higher staff planners those characteristics and capabilities of Air Force aircraft needed by them in the conduct of planning for airborne operations. The aircraft data presented are an estimate of the actual performance data which may be expected during time of war. Some aircraft loads exceed design load conditions but are within acceptable alternate overload limits. The method of presentation used is designed to show the capabilities of the several aircraft in each of the types of operations in which they may be employed. These operations are parachute and air transport.

b. *Glossary of Terms.*

(1) *Allowable cargo load (air)* — the amount of cargo, determined by weight, cubic displacement, and distance to be flown, which may be transported by aircraft. In an airborne operation, the Air Force commander will announce the allowable cargo load for each type aircraft.

(2) *Variations in the allowable cargo load.* The allowable cargo load of an aircraft varies according to distance and certain other conditions. The greater the distance, the greater the weight of fuel and resultant reduced allowable cargo load. In radius operations, the allowable cargo load for the distance traveled for parachute operations generally is greater than that for air-landed operation because there is a necessary safety restriction on the

total weight of the aircraft on landing. The allowable cargo load for an aircraft can be determined for any range or radius by reference to graphs provided for that purpose.

- (3) *Radius of action*—the maximum distance to which an airplane can safely travel and return without refueling. Operations under radius conditions are those in which aircraft deliver troops or materiel at a destination and return without refueling.
- (4) *Range*—the distance from the takeoff point to the point where an airplane delivers its cargo load (safety margin of reserve fuel included). Refueling is required to return to the original takeoff point.
- (5) *Typical safe equipment loads*. These are combination equipment loads within the weight limits of the allowable cargo load that expeditiously and safely can be loaded into a cargo aircraft without modification or disassembly, and which can be balanced and secured for safe flight. Vehicle and trailer loads are computed on empty weights for simplicity. This permits simple computation for remaining weight capacities.
- (6) *Weight factors*. The following factors are used in all computations:
 - (a) A fully equipped parachutist weighs 260 pounds.
 - (b) A fully equipped air-landed passenger weighs 240 pounds. An air-transported passenger for administrative air movements weighs 200 pounds plus authorized baggage allowance.
 - (c) Representative types of aerial delivery containers:
 - 1. A-7A container—net capacity—447 pounds; gross weight—500 pounds.
 - 2. A-21 container—net capacity—424 pounds; gross weight—500 pounds.
 - 3. A-22 container—net capacity—2,142 pounds; gross weight—2,200 pounds.

- 4. The 6,000-pound aerial delivery platform has a net capacity of 6,000 pounds and a gross weight of 7,385 pounds.

c. *Aircraft Characteristics.*

(1) *C-54 Skymaster.*

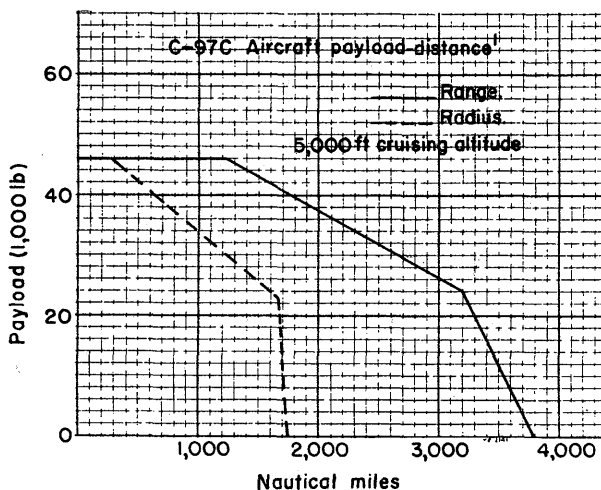
- (a) *Description*. The C-54 Skymaster is a low-wing, all-metal, four-engine, medium transport. (Limited standard.)
- (b) *Troop transport provisions*.
 - 1. Number of troop seats—49.
 - 2. Troop entrance—through door at left rear of fuselage by means of removable step or organic ladder.
 - 3. Baggage—in cargo compartment with troops or in compartment below flight deck.
- (c) *Litter transport provisions*. Number of litter positions—36.
- (d) *Cargo transport provisions*.
 - 1. Cargo compartment dimensions.
 - (a) Length—597 inches.
 - (b) Width—108 inches.
 - (c) Height—93 inches.
 - 2. Height of cargo entrance above ground—100 inches.
 - 3. Cargo doors.
 - (a) Location—left rear side of fuselage.
 - (b) Dimensions—95 in. wide x 67 in. high.

(2) *C-97C Stratofreighter.*

- (a) *Description*. The C-97C is a low-wing, all-metal, four-engine, heavy-transport airplane.
- (b) *Troop transport provisions*.
 - 1. Number of troop seats—130.
 - 2. Troop entrance—one door on each side of main compartment, one door on left side of lower front compartment.
 - 3. Means of loading—troop steps or ramp for personnel; ramp for vehicles.
- (c) *Litter transport provisions*. Number of litter positions—79 (in place of seats).
- (d) *Cargo transport provisions*.
 - 1. *Cargo compartment provisions*.
 - (a) Main cargo compartment—764 in. long, 105½ in. wide (maxi-

mum), 87 in. (minimum); 96 in. high (maximum); 87 in. high (minimum).

- (b) Lower cargo compartments, two each—264 in. long, 74 in. wide, and 60 in. high.
2. Height of cargo compartment above ground—115 inches.
3. Cargo door—on rear underside of fuselage on level of main compartment. Size opening—88 in. to 110 in. wide x 96 in. to 120 in. high.
- (e) *Parachutist provisions.* This aircraft is not equipped for personnel parachute operations.
- (f) *Aerial delivery provisions.*
 1. Overhead monorail conveyors are provided which drop containers through flight operable rear cargo doors on the underside of the fuse. The capacity of the overhead monorail is 85 300-pound or 15 1,500-pound containers (using A-22 containers).
 2. Floor level conveyors from cargo doors are provided for gravity ejection during flight.
 3. The capacity for dropping packaged supplies from floor level conveyor is limited only by allowable cargo load.
 4. Heavy dropping of equipment from the C-97C has not yet been tested.



¹ Based upon AFM 400-5, 1 August 1956.

(g) *Typical equipment loads.*

1. 6 trucks, 1/4-ton, 4 x 4.
2. 4 trucks, weapons carriers, 3/4-ton, 4 x 4.
3. 2 trucks, weapons carriers, 3/4-ton, 4 x 4; 2 guns, 40-mm, M1, on carriage, M2A1.
4. 3 trucks, cargo, SWB, 2 1/2-ton, 6 x 6, with canvas cab.

Note. Combinations above can be carried only at distances for which the allowable cargo load is more than stated total weight of the vehicles.

(3) *C-119C Packet.*

(a) *Description.* The C-119C Packet is a high-wing, twin-boom, twin-engine, all-metal, medium transport.

(b) *Troop transport provisions.*

1. Number of seats—42 (20 additional seats can be installed).
2. Troop entrance—through at left front of fuselage by means of organic ladder.
3. Baggage—in cargo compartment with troops.
4. Number of air-transported troops—62.

(c) *Litter transport provisions.*

1. Number of litter positions—35.
2. Attendants—4.

(d) *Cargo transport provisions.*

1. Cargo compartment dimensions—see illustration below.
2. Height of cargo entrance and floor above ground—48 in.
3. Ground clearance under horizontal stabilizers—164 in.
4. Cargo door.

(a) Location—rear of fuselage.

(b) Dimensions—see illustration below.

5. Cargo loading aids.

- (a) Vehicles—portable ramps and snatch block fittings.
- (b) Bulk cargo—truck bed height of cargo floor and snatch block fitting for heavy loads.

(e) *Parachutist provisions.*

1. Maximum capacity—42.
2. Exit doors—at rear of fuselage on each side of the compartment.
3. Accompanying supplies—can be

dropped from the interior aerial delivery system.

(f) *Aerial delivery provisions.*

1. Monorail—aircraft are equipped with an interior overhead monorail system for discharging supplies through the paratainer well. Capacity of the monorail—twenty 500-pound aerial delivery containers (10,000 pounds).
2. Floor level conveyors—all models of this aircraft can be fitted for ejecting supplies or equipment from the rear of the fuselage. The clamshell cargo doors are removed and the supplies or equipment are placed on top of wheel conveyors positioned on the floor of the cargo compartment. Capacity of the conveyor system is governed only by the allowable cargo load and interior dimensions of the aircraft. With clamshell doors removed, seven 2,200-pound A-22 (aerial resupply) equipment containers can be ejected from the cargo compartment out of the cargo door on a 806-mile radius mission.

(g) *Typical safe equipment loads (air landed).*

1. 3 trucks, $\frac{1}{4}$ -ton, 4 x 4; and 3 trailers, $\frac{1}{4}$ -ton.
2. 2 weapons carriers, $\frac{3}{4}$ -ton, 4 x 4.
3. 1 truck, cargo, $2\frac{1}{2}$ -ton, LWB, 6 x 6, with canvas cab; and 1 trailer, $1\frac{1}{2}$ -ton, 2-wheel.
4. 1 truck, $\frac{3}{4}$ -ton, 4 x 4, M37; and 1 howitzer, 105-mm, M2A1, carriage M2A2.
5. 1 truck, $\frac{3}{4}$ -ton, 4 x 4 ambulance; and 1 truck, $\frac{3}{4}$ -ton, 4 x 4, M37.
6. 1 tractor, crawler-type, diesel, 8,600–12,000 DBP, D6, with dozer.
7. 1 truck, $\frac{3}{4}$ -ton, 4 x 4; and 1 gun, 76-mm antitank, T-124, on carriage, T-66.

Note. Combinations above can be carried only at distances for which the allowable cargo load is more than the stated total weight of the vehicles.

(h) *Heavy drop capabilities.* The C-119C can drop the following heavy equipment intact:

1. 3 trucks, $\frac{1}{4}$ -ton.
2. 2 trucks, $\frac{3}{4}$ -ton.
3. 1 truck, $2\frac{1}{2}$ -ton; 1 trailer, $\frac{1}{4}$ -ton.
4. 1 truck, $\frac{1}{4}$ -ton; 1 gun, antitank, 76-mm.
5. 1 truck, $\frac{1}{4}$ -ton; 1 howitzer, 105-mm; 2 containers, 2,200 pounds.
6. 1 gun, 40-mm; 1 quad .50 machinegun; 1 container, 2,200 pounds.
7. 2 cargo carriers, M29C (weasel).
8. 18,000 pounds of boxed supplies.
9. 7 containers, 2,200 pounds.

(i) *Mixed loads.* The C-119C can deliver the following mixed loads (equipment and personnel):

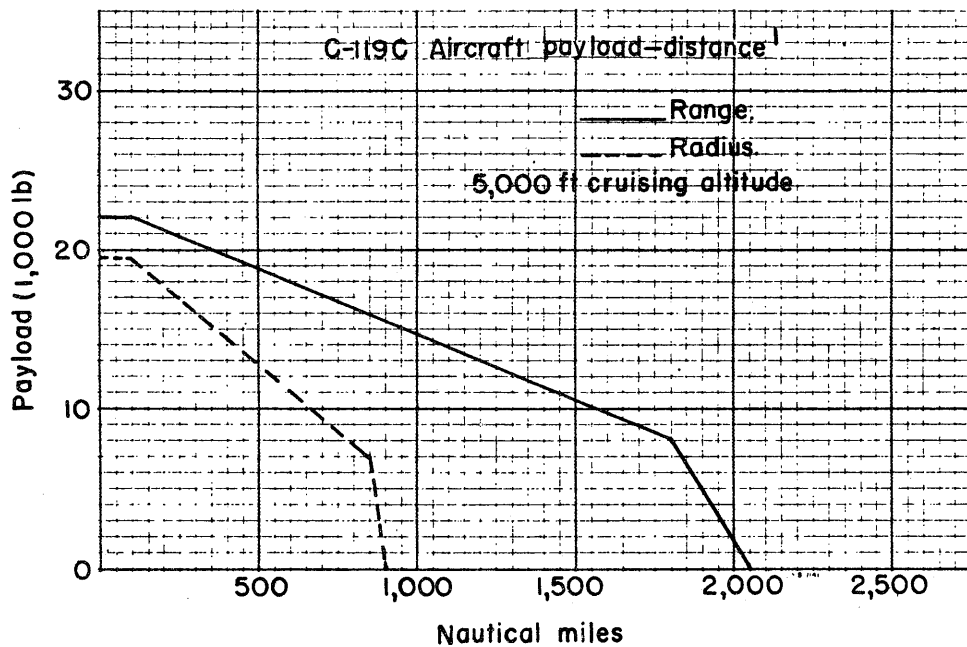
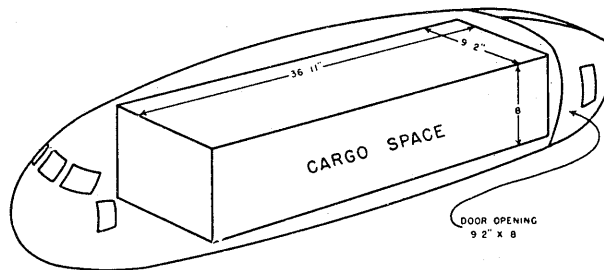
- 1 truck, $\frac{3}{4}$ -ton; 1 howitzer, 105-mm; followed by 4 personnel.
- 1 truck, $2\frac{1}{2}$ -ton, followed by 4 personnel.

(4) *C-123B.*

(a) *Description.* The C-123B medium assault airplane is a high-wing, twin-engine, full-cantilever monoplane of metal and steel tubing construction. It is capable of landing and taking off from unprepared fields.

(b) *Troop transport provisions.*

1. Number of troop seats—60.
2. Troop entrance—personnel doors on each side in rear portion of the fuselage. Dimensions—70 $\frac{1}{2}$ in. high, 36 in. wide. An additional door 23 in. wide and 60 in. high is located on the left side in the forward portion of the fuselage.
3. Baggage—in cargo compartment with troops.



¹ Based upon AFM 400-5, 1 August 1956.

4. Number of air-transported troops
—60.

(c) *Litter transport provisions.* Number of litter positions—50.

(d) *Parachutist provisions.* This aircraft is equipped for delivery of personnel by parachute and for limited heavy drop.

(e) *Aerial delivery provisions.* The C-123B will be tested in the near future for dropping heavy equipment by the use of floor conveyors.

(f) *Typical safe equipment loads (air landed).*

1. 3 trucks, $\frac{1}{4}$ -ton, 4×4 , and 3 trailers, $\frac{1}{4}$ -ton.

2. 2 trucks, weapons carriers, $\frac{3}{4}$ -ton, 4×4 .

3. 1 howitzer, 155-mm, M1.

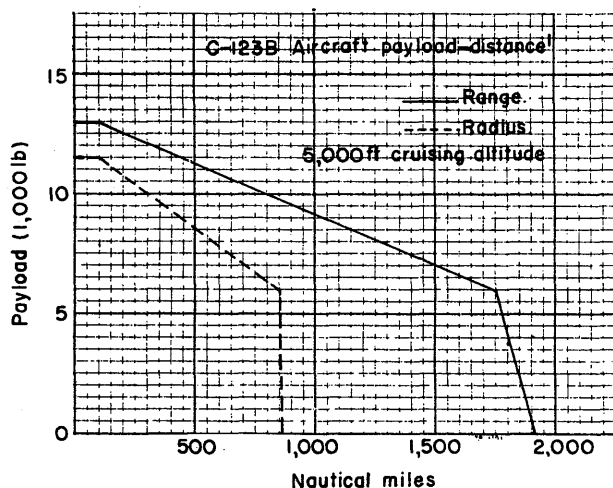
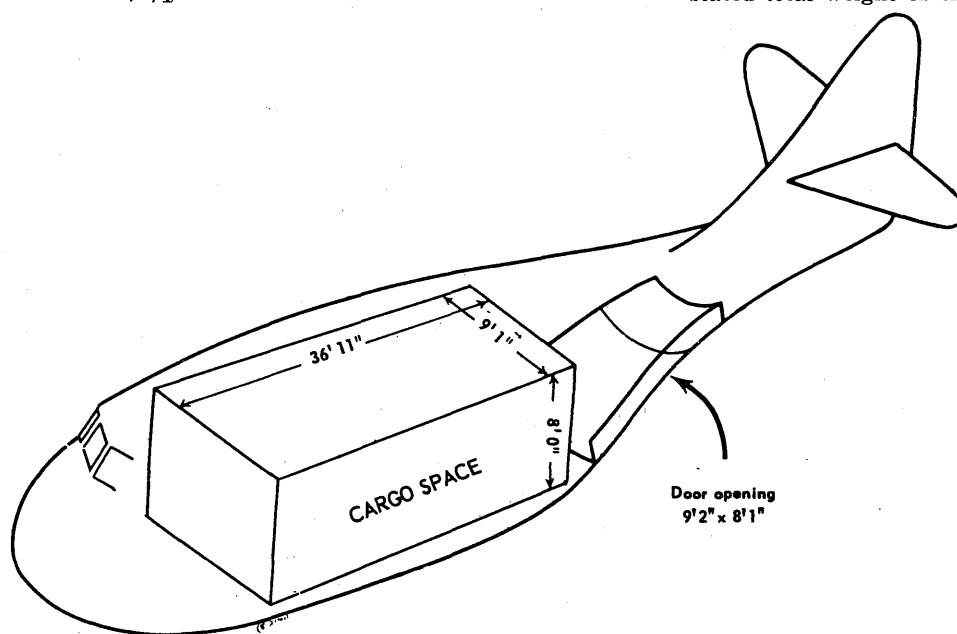
4. 1 compressor, air, truck-mounted, gasoline engine.

5. 1 carrier, half-track; one 81-mm mortar, M21.

6. 1 truck, cargo, $2\frac{1}{2}$ -ton, 6×6 , SWB, with canvas cab; and 1 howitzer, 105-mm, M2A1, on carriage, M2A2.

7. 1 tractor, crawler-type, diesel, 8,600–12,000 DBP, D6, with dozer.

Note. Combinations above can be carried only at distances for which the allowable cargo load is more than the stated total weight of the vehicles.



¹ Based upon AFM 400-5, 1 August 1956.

(5) C-124C.

(a) *Description.* The C-124C is a low-wing, all-metal, four-engine, heavy-transport monoplane.

(b) *Troop transport provisions.*

1. Number of troop seats—200 (located on 2 decks).
2. Baggage—in cargo compartment with troops or in compartments below flight deck.
3. Troop steps or ramp for personnel.

(c) *Litter provisions.* Number of litter positions—127 (in place of seats).

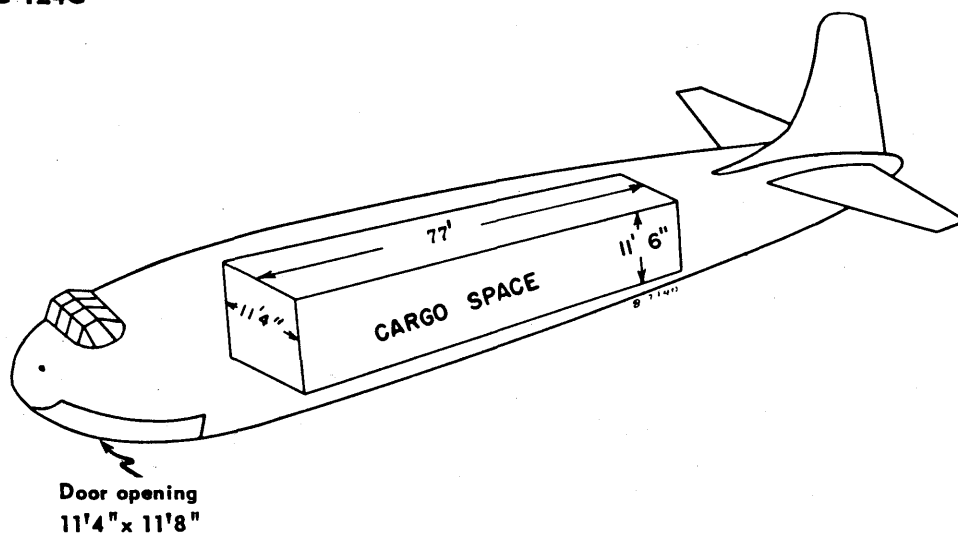
(d) *Parachutist provisions.* This aircraft can accommodate 112 para-

chutists when kit¹ is installed. Aircraft can accommodate equipment bundles up to size of A-22 container. It is not planned to use this aircraft for heavy drop because of limited capability and excessive weight penalty.

(e) *Cargo transport provisions.*

1. Overall dimensions (see illustration below).
2. Cargo compartment equipped with two decks.
3. Cargo door—clamshell doors open lower half of nose of airplane.

C-124C



(f) *Typical equipment loads.*

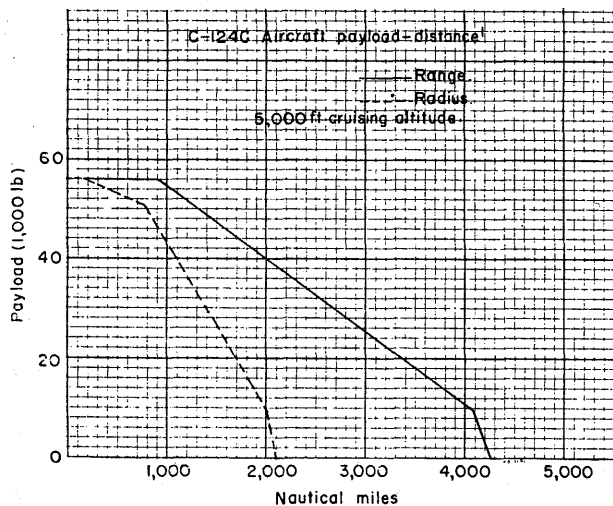
1. 8 trucks, 1/4-ton, 4 × 4; and 8 trailers, 1/4-ton, 2-wheel.
2. 1 tank, light, M41.
3. 1 howitzer, 155-mm, M1, on carriage, M1A2.
4. 1 tractor, high-speed, 13-ton, M5A3.
5. 3 trucks, 2 1/2-ton, 6 × 6, cargo, SWB, with winch.
6. 3 trucks, 2 1/2-ton, 6 × 6, cargo, LWB.
7. 1 howitzer, 105-mm, M2A1, on carriage, M2A2; 1 trailer, ammunition, M10; 1 truck, 2 1/2-ton, 6 × 6, SWB.

4. Cargo and equipment can be loaded either through the nose door by use of a ramp or by elevator in the aft end of the cargo compartment.
5. Dimensions of cargo door in nose—11.6 ft high × 11.3 ft wide.
6. Cargo elevator dimensions—13.3 ft long × 7.7 ft wide, capacity—16,000 pounds. Ground clearance of aircraft at elevator well—130 ft.

8. 1 carriage, motor, twin, 40-mm gun, M19.
9. 12 trucks, 1/4-ton, 4 × 4, M38.
10. 1 vehicle, utility, armored, M44.
11. 2 graders, road, motorized, diesel, engine-driven, 12-foot moldboard.
12. 1 gun, 90-mm, AA, M2, on mount AA, M-2, with equipment and supply; 1 truck, 2 1/2-ton, 6 × 6, cargo.
13. 4 helicopters, reconnaissance, H-13 or H-23.

Note. Combinations above can be carried only at distances for which the allowable cargo load is more than the stated total weight of the vehicles.

¹Kit includes primarily an anchor cable for parachute static line hookup.



¹Based upon AFM 400-5, 1 August 1956.

(6) C-130A.

(a) *Description.* The C-130A is a medium-range, four-engine, all-metal, high-wing monoplane.

(b) *Troop transport provisions.*

1. Number of troop seats—92.
2. Baggage—in cargo compartment with troops.
3. Entrance—by ramp at aft end or by ladder on either side through aft personnel doors.

(c) *Litter provisions.* Number of litter positions—74 (in place of seats).

(d) *Parachutist provisions.* The aircraft accommodates 64 parachutists. The aircraft is intended for use in heavy drop as well as troop and cargo transport.

(e) *Cargo transport provisions.*

1. Overall dimensions (see illustration below).
2. Aft cargo door—consists of cargo door (upper portion) and ramp door (lower portion). Cargo door folds upward into fuselage, and ramp lowers onto ground to form an opening almost the size of the cargo compartment.
3. Forward cargo door—there is a second large cargo door at the forward end of the cargo compartment on the left side. This door swings outward and upward by hydraulic control.

4. Loading aids—loading ramp at aft end of fuselage which can be opened to any desired position from a downward angle of $121\frac{1}{2}^\circ$ (contact with the ground) to fully closed. Two auxiliary truck-loading ramps 26 in. wide and 36 in. long are provided to bridge any gap between the ground and the upper edge of the integral ramp. Two snatch blocks are provided for winching loads into the aircraft. One is permanently fixed at the forward end of the cargo compartment, and one is movable. Winch is not a part of the aircraft.

5. Dimensions of the aft cargo door opening—120 in. wide $\times$ 110 in. high.

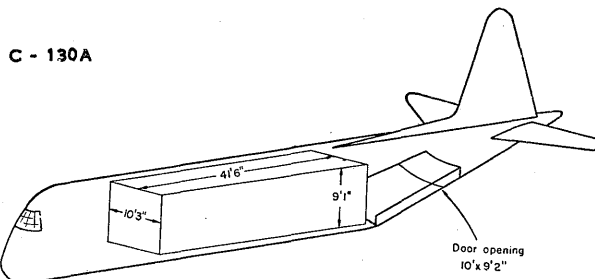
6. Height of aft cargo door above ground—41 in.

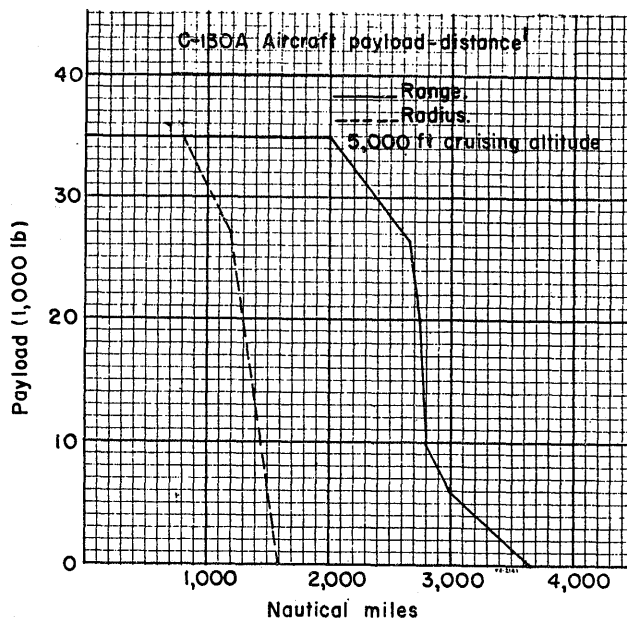
7. Dimensions of forward cargo door opening—80 in. wide $\times$ 72 in. high.

8. Height of forward cargo door above ground—41 in.

(f) *Typical equipment loads.*

1. Road grader, motorized, diesel-driven, 10 ft moldboard.
2. Truck-tractor, 4-wheel, 5-ton, with semitrailer, fuel servicing, 4-wheel, type F6.
3. Tractor, crawler-type, earth-moving, diesel-driven, HD6.
4. Truck, dump, 5-ton, 6 $\times$ 6, M51.
5. Howitzer, 8 in. M2, on carriage, with limber.
6. Carriage, motor, 105-mm howitzer (GLC).
7. Gun, 155-mm, on carriage, with limber.
8. Vehicle, utility, armored (GLC).





¹ Based upon AFM 400-5, 1 August 1956.

Section VIII. INLAND WATERWAYS

7.46. General

a. Types. Inland waterways include all navigable inland waters such as rivers, lakes, inland channels, and canals of sufficient depth to accommodate cargo traffic. The following are the general types into which inland waterways are grouped:

- (1) Lakes.
- (2) Rivers.
- (3) Ship canals.
- (4) Barge canals.
- (5) Intracoastal waterways.

b. Characteristics. The characteristics of a waterway which must be considered in an analysis of its capabilities are as follows:

- (1) Restricting widths and depths of channel.
- (2) Vertical and horizontal bridge clearance.
- (3) Location of dams and other bars to navigation.
- (4) Location of locks, dimensions, and timing.
- (5) Seasonal floods and droughts, their frequency and duration.
- (6) Normal freezeup and opening dates.
- (7) Hazards to navigation, such as rapids and falls.
- (8) Speed and fluctuation of current.

- (9) Waterway maintenance requirements.
- (10) Changes of channel.

7.47. Waterway Capacity Estimates

a. Limiting Factors. Factors, other than waterway characteristics, having a limiting effect on waterway capacity are—

- (1) Availability of suitable barges or craft.
- (2) Availability of suitable operating personnel.
- (3) Availability and adequacy of terminals and terminal facilities.

b. Turnaround Time. This factor is defined as the time required for a barge or craft to load, travel to destination, unload, return to origin, and be ready to resume loading. It has considerable effect on waterway capacity and involves—

- (1) Length of haul, taken as round-trip distance.
- (2) Speed in still water—4 miles per hour.
- (3) Speed and direction of current.
- (4) Loading and unloading time—computed at 8.4 short tons per barge per hour.
- (5) Time consumed in locks.
- (6) Operating hours per day—normally taken as 20, allocating the remaining

4 for maintenance, refueling, restoring, etc.

c. Capacity Determination, Craft Available To Fill or Exceed Waterway Capacity. When sufficient barges or craft are available to fill or exceed waterway capacity, the daily tonnage that may be moved over the waterway is equal to one-half the number of craft per day that can be passed through the most limiting constriction (example, a lock, lift bridge, narrow channel, etc.) times the average net capability of the craft in use.

d. Capacity Determination, Craft Not Available To Fill or Exceed Waterway Capacity. The following formula may be used to determine the number of tons a given number of barges can transport a given distance daily:

$$\frac{\text{Number of barges} \times \text{tons per barge} \times \text{hours of operation per day}}{\text{Turnaround time in hours}} = \text{tons moved daily}$$

Example: Determine the daily tonnage 20 barges of 270 short tons capacity each can move 60 miles forward with no lost time in locks and negligible effect due to current.

$$\text{Travel time per barge} = \frac{60 + 60}{4} = 30 \text{ hours}$$

$$\text{Loading and unloading time per barge} = \frac{2 \times 270}{8.4} = 64.3 \text{ hours}$$

$$\text{Turnaround time per barge} = 30 + 64.3 = 94.3 \text{ hours}$$

$$\frac{20 \text{ barges} \times 270 \text{ tons per barge} \times 20 \text{ hours daily availability}}{94.3 \text{ hours turnaround time}} = 1,145.3 \text{ short tons daily}$$

7.48. Floating Equipment Requirements

a. Cargo Craft. To determine the number of barges or cargo craft required to move a given tonnage a given distance forward daily, use the following formula:

$$\frac{\text{Daily tonnage} \times \text{hours turnaround time}}{\text{Tons per barge} \times \text{hours of operation daily}} = \text{Number barges required}$$

Example: Determine the number of barges having a capacity of 500 short tons required to move 1,000 short tons daily a distance of 100 miles forward, assuming no lost time in locks and negligible effect due to current.

$$\text{Travel time per barge} = \frac{100 + 100}{4} = 50 \text{ hours}$$

$$\text{Loading and unloading time per barge} = \frac{2 \times 500}{8.4} = 119 \text{ hours}$$

$$\text{Turnaround time per barge} = 50 + 119 = 169 \text{ hours}$$

$$\frac{1,000 \text{ tons daily} \times 169 \text{ hours turnaround}}{500 \text{ tons per barge} \times 20 \text{ hours daily operation}} = 16.9 \text{ barges} = 17 \text{ barges required}$$

b. Tugs and Towboats. Since a single tug or towboat can normally be used to tow more than one barge and loading time is not a consideration in tug or towboat availability, it follows that fewer tugs than barges will be required in any given situation. To determine the number of tugs or towboats required to efficiently operate a given number of barges in a given situation, use the following formula:

$$\text{Number of tugs} = \frac{\text{Total number of barges} \times \text{turnaround time for tugs in days}}{\text{Number of barges per tow} \times \text{turnaround time for barges in days}}$$

Example: Determine the number of tugs required to operate 400 barges, when each tow consists of 5 barges, turnaround time for barges is 4 days, and turnaround time for tugs is 2 days.

$$\frac{400 \text{ barges} \times 2 \text{ days tug turnaround}}{5 \text{ barges per tow} \times 4 \text{ days barge turnaround}} = 40 \text{ tugs required}$$

Section IX. OCEAN SHIPPING

7.49. Definition of Ship-Loading Terms

a. Units of Weight.

- (1) Short ton (ston)—2,000 pounds. Used by US ships in domestic trade.
- (2) Long ton (lton)—2,240 pounds. Used by US ships in foreign trade.

- (3) Metric ton—2,205 pounds. Used by foreign shipping.

b. Units of Volume.

- (1) Measurement ton (mton)—40 cubic feet. Used by US ships in foreign trade.

- (2) Register ton—100 cubic feet. (This tonnage is used for working out a basis to collect entry fees for the vessel and has no direct bearing on the cargo-carrying capacity of the vessel.)

c. Units of Distance and Speed.

- (1) Distance—nautical mile (NM) = 6,080 feet.
 (2) Speed—knot (K) = 1 nautical mile per hour.

d. Gross Tonnage. Gross tonnage (gross register tonnage) is the entire internal cubic capacity of a ship expressed in register tons of 100 cubic feet each.

e. Net Tonnage. Net tonnage (net register tonnage) of a ship represents the cargo and passenger-earning spaces which remain after deduction from the gross tonnage of space for the crew, powerplant, fuel, and operation of the vessel. Net tonnage is expressed in tons of 100 cubic feet each.

f. Deadweight Tonnage. Deadweight tonnage is the carrying capacity of a ship expressed in long tons and represents the difference between displacement loaded to maximum draft allowed by law and displacement light.

g. Displacement Tonnage Light. Displacement tonnage light is the weight of a ship in long tons and excludes the weight of cargo, passengers, fuel, water, stores, dunnage, and such other items necessary for use on a voyage.

h. Displacement Tonnage Loaded. Displacement tonnage loaded is the weight of a ship in long tons and includes the weight of cargo, passengers, fuel, water, stores, dunnage, and such other items necessary for use on a voyage.

i. Cargo Deadweight Tonnage. Cargo deadweight tonnage is the weight-lifting capacity of a ship in long tons, remaining after deducting from the deadweight tonnage the weight of fuel, water, stores, dunnage, and such other items as may be necessary for a voyage.

j. Grain Cubic Capacity. Grain cubic capacity is the maximum space available for cargo measured in cubic feet, the measurements being taken to the inside of the shell plating of the ship or to the outside of the frames and to the top of the beams or underside of the deck plating. If a bulk cargo of grain was loaded, it would flow in between the frames and beams and occupy the maximum space available. This is the grain cubic capacity.

k. Bale Cubic Capacity. Bale cubic capacity of a ship is the number of cubic feet of space available for cargo measured to the inside of the cargo battens, on the frames, and to the underside of the beams.

l. Lost Space. Lost space (broken stowage, stowage loss) is the difference between the ship's cubic measurement and total measurement of the cargo. Although allowance for lost space varies a great deal with individual types of cargo, the average allowance for the entire spread of military cargo amounts to the following, which is given in percentage of bale cubic capacity:

	Percent
(1) Commercial loading-----	20
(2) Commodity loading-----	30
(3) Combat loading-----	50
(4) Selective loading-----	30

m. Stowage Factor. A stowage factor is a relationship of cubage to weight. As applied to cargo, it is the ratio of the number of cubic feet of space occupied by the cargo to the weight of the cargo in long tons. The units in which a stowage factor is expressed are stated as "cubic feet per long ton." In individual items or types of cargo, it is the amount of cubic feet of space occupied by one long ton.

n. Vessel Stowage Factor. Vessel stowage factor = (bale cubic capacity—estimated lost space) ÷ (cargo deadweight tonnage—estimated weight of deck cargo).

- (1) To determine whether weight or volume of a specific commodity will be the limiting factor in loading a Liberty type ship of 400,000 cubic feet capacity after deducting lost space and with a cargo capacity tonnage (less deck-load) of 8,000 long tons.

$$\text{Vessel factor} = \frac{400,000 \text{ cubic feet}}{8,000 \text{ long tons}} = 50 \text{ cubic feet/long ton}$$

- (2) Under the conditions stated above, the vessel will have its cargo space completely filled and its weight capacity utilized if stowed with cargo occupying 50 cubic feet to the long ton. In this example, for cargo occupying more than 50 cubic feet per long ton, volume will be the limiting factor. For cargo occupying less than 50 cubic

feet per long ton, weight will be the limiting factor.

7.50. Shipping References

- a. *Naval Logistical Reference Data.*
- b. *U. S. Marine Corps Amphibious Manual A.M. 11 (1949).*
- c. *FM 60-30. Amphibious Operations, Embarkation and Ship Loading (Unit Loading Officer).*

7.51. Commercial Loading Methods

a. *Bulk and General Cargo Loading.* Bulk and general cargo loading is the stowage of supplies to utilize the entire carrying capacity of a ship, disregarding segregation of cargoes either by class, technical service, or commodity. It permits maximum economy in shipping space but requires additional labor and facilities at destination for segregation and assembly of supplies for use.

b. *Multiple Port Discharge.* Multiple port discharge utilizes bulk stowage of supplies for more than one destination loaded so as to maintain availability for discharge of proper items in the order of arrival at the ship's scheduled destinations.

7.52. Military Loading Methods

Military cargo is loaded on board ships according to its intended employment at its destination. There are four distinct types of military loading.

a. *Combat Loading.* Combat loading gives primary consideration to facility with which troops, equipment, and supplies can be unloaded and ready for combat upon landing, rather than to economical utilization of ship space. There are three methods of combat loading. They differ mainly as to the degree of availability of troop units for landing and as to the tactical integrity of the units.

- (1) *Combat unit loading.* Combat unit loading is the loading of an assault troop unit, together with its essential combat equipment and supplies, in a single ship in such a manner that the unit will be available to support the tactical plan upon debarkation and to provide for a maximum of flexibility to meet possible changes in the tactical plan.

- (2) *Combat organizational loading.* Combat organizational loading is the loading of a troop unit with its equipment and supplies on the same ship, but without regard to tactical considerations upon debarkation. It permits debarkation of complete units and equipment which are available for employment after assembly ashore. This method is more economical in ship space than combat unit loading.
- (3) *Combat spread loading (also called convoy loading).* Combat spread loading is the loading of troop units, with their equipment and supplies, on ships in the same convoy, but not necessarily the same ship. This method is commonly used with troop units with heavy equipment. Units so loaded are available for employment when landed at established beachheads or ports after a lapse of time necessary to assemble them on land with their equipment and supplies.

b. *Commercial Loading.* Commercial loading gives primary consideration to the loading of troops and/or equipment and supplies in a ship for maximum utilization of personnel and cargo space. No consideration is given to debarkation priorities. Therefore, equipment and supplies must be unloaded and sorted before they can be used. This type loading may be employed effectively for reinforcing and maintaining an expeditionary force and for carrying supplies and equipment for the buildup forces.

c. *Commodity Loading.* Commodity loading is—

- (1) In naval usage, a method of loading in which various types of cargo are loaded together, such as ammunition, rations, or boxed vehicles, in order that each commodity can be discharged without disturbing the others.
- (2) In Army and Air Force usage, a method of loading a ship with one class of supply or with supplies of a single technical service.

d. *Selective Loading.* Selective loading is the arrangement and stowage of equipment and supplies aboard a ship in a manner designed to facilitate issue to units. Specific items may be discharged on call.

7.53. Nomenclature of Maritime Commission Oceangoing Vessels

Note. There is such a large difference in the cubic-carrying capacity of vessels of the same type, because

of various alterations and special fittings, that the cubic feet and tonnage figures shown in the tables in this paragraph and in paragraph 7.54 are, in most instances, minimum and apply to one type of the designated vessels only.

Type	Deadweight tonnage	Remarks
B7	5,700	Concrete hull, cargo barge, nonpropelled.
C1A	7,400	Designed for general cargo in world trade; steam turbine and motor-propelled (2 modifications).
C1B	9,100	Designed for general cargo in world trade; steam turbine and motor-propelled (3 modifications).
C1M	5,000	Designed for general cargo; motor-propelled.
C1S	5,000	Concrete ship designed for cargo purposes; steam-reciprocating-engine propelled.
C2	9,300	Designed for general cargo in world trade; majority steam-turbine propelled (several modified types). Modified types were used mostly as hospital ships.
C3	9,900	Combination passenger and cargo ship; majority steam-turbine propelled (several modified types).
C3S	12,300	Designed for cargo; steam-turbine propelled.
C4	15,000	Designed for cargo; steam-turbine propelled (2 modifications).
C4-S-1A	12,900	Mariner class vessel. Recently developed by Maritime Administration in cooperation with the Department of Defense to provide modern high-speed commercial-type vessels which can readily be converted for wartime shipping.
EC2	10,800	Liberty type designed for general cargo; steam-reciprocating-engine propelled. Several modified types, prefixed by the symbol Z, were designed as tank carriers and later modified as plane carriers.
L6	15,700	Specially designed for bulk ore, coal, or grain trade on the Great Lakes; steam-reciprocating-engine propelled.
N3	2,800	Cargo carrier designed for coastal trade; steam-reciprocating-engine propelled.
P1	1,900	Specially designed passenger-type vessel; steam-turbine propelled.
P2	10,000-12,000	Designed to carry troops. Two types, 1 turbine-electric propelled, 1 steam-turbine propelled.
T1	1,500-4,200	Designed for tanker service in coastal and inland waters; diesel-propelled (4 modifications).
T2	16,000	Designed to carry bulk oil in world trade; turbo-electric propelled (4 modifications).
T3	16,500	Designed to carry bulk oil in world trade; steam-turbine propelled (6 modifications).
V4	800	Large diesel-powered oceangoing tug.
VC2	10,200	Victory type designed to carry cargo in world trade. Four types, 1 has 6,000 HP engine, 3 have 8,500 HP engines. Three are steam-turbine propelled, 1 diesel-propelled.

7.54. Cargo Vessel Characteristics

a. Physical Characteristics.

	1	2	3	4	5	6	7
	Vessel	Gross register tonnage	Overall length (ft)	Beam (ft)	Sustained speed (knots)	Cruising range (NM)	Summer draft (ft)
1							
2	Liberty.....	7,100	442	57	11.0	¹ 9,000	28
3	Victory.....	7,600	455	62	15.5	23,000	29
4	C1 B Cargo.....	6,700	418	60	14.0	24,000	28
5	C2 Cargo.....	6,181	459	63	15.0	16,000	26
6	C3 Cargo.....	7,900	492	70	16.5	11,700	29
7	C4 Cargo.....	10,780	520	71	17.0	9,000	33
8	FS Freighter ²	560	176	32	12.0	4,000	12
9	C1 M AV 1 Freighter.....	3,805	339	50	11.0	25,000	21
10	T2SE Tanker.....	10,200	524	68	14.5	12,600	30
11	ZET 1 Tanker ³	7,000	442	57	11.0	17,000	28
12	C4 Mariner.....	9,200	564	76	20.0	23,000	30

¹ Cruising range can be increased to 18,000 miles if deep tanks are used for fuel oil. See footnote 2 in c below.

² FS type (freight service ship) is the 176-foot vessel built for the Army. It is an oceangoing vessel but, because of its small capacity, is used principally as an interisland carrier.

³ Converted Liberty.

b. Hold, Hatch, and Boom Data.

	1	2	3	4	5	6
	Vessel	Cargo holds (number)	Boom capacity (lton)	Booms (number)	Capacity heavy lift rigs (lton)	Hatches w/heavy lift booms (by number)
1						
2	Liberty.....	5	5	12	¹ 50-15	2-4
3	Victory.....	5	5	16	¹ 50-30	¹ 3-4
4	C1 B Cargo.....	5	5	15	30	2
5	C2 Cargo.....	5	5	17	50	3
6	C3 Cargo.....	5	5-10	21	30	5
7	C4 Cargo.....	7	5	24	50	4-5
8	FS Freighter ²	2	5	5	15	2
9	C1 M AV 1 Freighter.....	4	³ 3-5	12	30	2-3
10	C4 Mariner.....	7	5-10	26	60	4-6

¹ Some Libertys have a 30-ton boom at No. 2 hatch and a 15-ton boom at No. 4 hatch. Other Liberty ships have a 50-ton boom at No. 2 hatch and a 30-ton boom at No. 4 hatch. All Victorys have a 30-ton boom at No. 4 hatch.

² FS type (freight service ship) is the 176-foot vessel built for the Army. It is an oceangoing vessel but, because of its small capacity, is used principally as an interisland carrier.

³ Two 3-ton booms (No. 4 hatch) and ten 5-ton booms.

c. Vessel Capacities.

	1	2	3	4	5	6	7
	Vessel	Deadweight (lton)	Meas tons ^{1 2}	Bale cubic capacity (cu ft) ^{1 2}	Grain cubic capacity (cu ft) ¹	Refrg cargo (cu ft)	Liquid cargo (bbl)
1							
2	Liberty.....	10,800	11,886	475,444	563,257	-----	-----
3	Victory.....	10,800	11,413	456,525	528,325	-----	-----
4	C1 B Cargo.....	9,100	11,300	452,000	508,000	-----	-----
5	C2 Cargo.....	9,250	11,823	472,935	548,560	-----	-----
6	C3 Cargo.....	12,300	18,425	736,980	815,470	³ 45,000	-----
7	C4 Cargo.....	14,863	17,790	672,240	727,430	⁴ 32,375	-----
8	FS Freighter.....	470	483	19,320	21,462	-----	-----
9	C1 M AV 1.....	5,032	5,699	227,930	250,000	9,830	4,000
10	T2SE Tanker.....	16,583	381	15,230	-----	-----	141,000
11	ZET 1 Tanker ⁵	10,800	-----	-----	-----	-----	65,000
12	Supertanker ⁶	25,000	-----	-----	-----	-----	165,000
13	C4 Mariner.....	12,900	18,418	736,723	837,305	30,254	-----

¹ On-deck space or lost space in stowage not included.

² Does not include capacity of deep tanks of which the Liberty type ship has 3. Deep tanks No. 1 and No. 2, with approximately 16,000 cubic feet of capacity, may be used for dry or liquid cargoes if not in use for vessel voyage requirements. No. 3 deep tank is rigged for either fuel oil or bulk cargo liquids. A 5,000-barrel (703 lton) payload can be shipped in this tank if the contemplated voyage is to be short enough that No. 3 tank will not be needed for fuel oil.

³ Standard C3 has no refrigerated cargo capacity; figure given is for C3 passenger and cargo type.

⁴ Standard C4 has no refrigerated cargo capacity; figures given are for C4-S-A4 type.

⁵ Modified Liberty.

⁶ Supertankers are those tankers of over 25,000 DWT, which run up to 100,000 DWT or higher.

d. Detailed Capacities Below Deck.

	1	2	3	4	5	6
1	Ship type	Hatch number	Hatch dimensions	Cargo capacities in measurement tons		
				Hold	*Tween deck	Deep tanks
2	Liberty-----	1	33 ft 9 in x 20 ft-----	900	983	416
		2	35 ft 0 in x 20 ft-----	2,300	1,065	0
		3	20 ft 0 in x 20 ft-----	1,495	597	0
		4	35 ft 0 in x 20 ft-----	1,315	742	0
		5	35 ft 0 in x 20 ft-----	1,290	771	0
	Total-----			7,200	4,158	416
3	FS Freighter----	1	16 ft 0 in x 20 ft 0 in-----	251	0	0
		2	16 ft 0 in x 28 ft 0 in-----	285	0	0
	Total-----			536	0	0

* Known as the "focsle."

	1	2	3	4	5	6	7
1	Ship type	Hatch number	Hatch dimensions	Cargo capacities in measurement tons			
				Hold	Upper *tween deck	Lower *tween deck	Deep tanks
2	Victory-----	1	22 ft 3 in. x 25 ft-----	963	1 466	588	0
		2	22 ft 3 in. x 24 ft-----	675	675	545	0
		3	22 ft 3 in. x 36 ft-----	1,320	1,139	989	0
		4	22 ft 3 in. x 36 ft-----	1,276	1,224	0	0
		5	22 ft 4 in. x 24 ft-----	647	1,086	0	0
	Total-----			4,611	4,590	2,122	0
3	C1 B-----	1	29 ft 3 in. x 20 ft-----	862	481	398	0
		2	31 ft 6 in. x 20 ft-----	1,437	750	741	0
		3	31 ft 6 in. x 20 ft-----	1,222	845	779	102
		4	31 ft 6 in. x 20 ft-----	0	779	1,229	480
		5	31 ft 6 in. x 20 ft-----	608	473	0	0
	Total-----			4,129	3,328	3,138	582
4	C1 M AV 1-----	1	20 ft 2 in. x 19 ft 11 in-----	472	509	0	0
		2	18 ft 10 in. x 14 ft 11 in-----	1,100	924	0	0
		3	40 ft 4 in. x 19 ft 10 in-----	875	612	0	0
		4	8 ft 0 in. x 8 ft 0 in-----	113	36	133	0
	Total-----			2,560	2,081	133	0
5	Mariner-----	1	24 ft 3 in. x 18 ft 6 in-----	305	402	453	0
		2	30 ft 0 in. x 24 ft 0 in-----	637	731	865	0
		3	40 ft 0 in. x 30 ft 0 in-----	1,284	1,050	1,454	0
		4	40 ft 0 in. x 30 ft 0 in-----	1,528	1,006	1,500	0
		5	40 ft 0 in. x 30 ft 0 in-----	401	1,044	410	953
		6	40 ft 0 in. x 30 ft 0 in-----	1,646	965	0	298
		7	25 ft 0 in. x 30 ft 0 in-----	856	627	0	0
	Total-----			6,657	5,825	4,682	1,251

* Known as the "focsle".

e. Composition of Deadweight Tonnage. Five types comprise the majority of all shipping available for military use. Further detailed data for these vessels follow. It is to be noted that ships' capacities are expressed in long tons in order to agree with normal shipping procedures; whereas, the discharge and loading capabilities of Transportation Corps terminal service companies are expressed in short tons in order to agree with practices of other means of transportation.

	1	2	3	4
1	Vessel	Maximum ship-operating supplies* (lton)	Cargo capacity tonnage when operating supplies (lton) are maximum*	Total (lton)
2	Liberty-----	2,800	8,000	10,800
3	Victory-----	3,100	7,500	10,600
4	C1 B-----	1,850	7,250	9,100
5	C1 M AV 1-----	1,047	6,393	7,440
6	Mariner-----	4,065	9,353	13,418

*Operating supplies include fuel, water, dunnage, and ship stores. Additional payload capacity may be substituted to a limit dependent on length of voyage and character of cargo, which will warrant a reduction in such ship-operating supplies.

f. Vehicle Loading Capacities.

	1	2	3	4	5	6	7	8	9	10	11
1	Vessel	Trucks, ¼-ton ¹		Trailers, 1½-ton ¹		Trucks, cargo, ¾-ton ¹		Trucks, cargo, 2½-ton, 6 x 6, LWB		Trucks, cargo, 5-ton, 6 x 6, LWB	
		On wheels	Crated ²	On wheels	Crated ²	On wheels	Crated ²	On wheels	Crated ²	On wheels	Crated ^{2,3}
2	Liberty-----	498	2,078	404	4,493	312	744	4 185	857	102	
3	Victory-----	512	1,983	512	4,287	331	710	193	340	114	
4	C1 B-----	511	1,912	491	4,133	337	684	182	328	145	
5	C1 M AV 1-----	314	645	261	456	167	280	111	114	61	
6	Mariner-----	1,181	1,740	891	1,732	665	966	364	328	229	

¹ Double the number of ¼-ton trucks on wheels can be stowed if they are stacked. It also is estimated that at least 35 percent more 1½-ton trailers can be loaded if stowed in tandem with drawbar nested inside body of preceding trailer, providing tail gates are drop type. Regarding the other three types of vehicles, more can be stowed in the Liberty ship by double-decking; see note to C1 B table in *g* below.

² All crated vehicles are boxed by single units except the 1½-ton trailers, which are boxed by twin units.

³ The 5-ton truck, M54, is not shipped crated.

⁴ One hundred and fifty-three ¼-ton trucks may be loaded in the bodies of 153 of these trucks. The other 32 trucks will not take jeeps because of the limiting height of the compartments in which stowed. As an alternative, a total of 215 trucks can be stowed by double-decking in No. 2 and 3 holds.

g. Detailed Vehicle Loading Capacities (stowed on wheels).

C1 B*						
1	2	3	4	5	6	7
Hatch No.	Location	Trucks, utility, ¼-ton	Trailers, cargo, 1½-ton	Trucks, cargo, ¾-ton	Trucks, cargo, 2½-ton, 6 x 6, LWB	Trucks, cargo, 5-ton, 6 x 6, LWB
1	On deck-----	14	14	12	5	7
	Upper 'tween deck-----	21	18	12	6	4
	Lower 'tween deck-----	21	18	12	6	5
	Lower hold-----	14	13	9	4	4
2	On deck-----	25	21	18	12	7
	Upper 'tween deck-----	46	37	25	13	12
	Lower 'tween deck-----	42	37	25	15	12
	Lower hold-----	34	36	21	13	11
3	On deck-----	23	21	14	10	5
	Upper 'tween deck-----	44	42	30	17	12
	Lower 'tween deck-----	41	42	28	13	12
	Lower hold-----	41	42	28	13	9
4	On deck-----	21	21	14	10	7
	Upper 'tween deck-----	39	41	26	14	12
	Lower 'tween deck-----	36	37	24	12	10
	On deck-----	16	18	12	7	5

See footnotes at end of table.

C1 B*						
1	2	3	4	5	6	7
Hatch No.	Location	Trucks, utility, ¼-ton	Trailers, cargo, 1½-ton	Trucks, cargo, ¾-ton	Trucks, cargo, 2½-ton, 6 x 6, LWB	Trucks, cargo, 5-ton, 6 x 6, LWB
5	'Tween deck.....	23	23	15	7	5
	Hold.....	10	10	12	6	6
	On deck.....	22	22	14	9	6

* Number of vehicles (except 5-ton, 6 x 6) in lower holds of No. 2 and 3 hatches can be doubled by flooring over one layer of vehicles and loading a second layer directly on top. The depth of only these two holds will permit such double-decking.

Liberty Ship						
1	2	3	4	5	6	7
Hatch No.	Location	Trucks, utility, ¼-ton	Trailers, cargo, 1½-ton	Trucks, cargo, ¾-ton	Trucks, cargo, 2½-ton, 6 x 6, LWB	Trucks, cargo, 5-ton, 6 x 6, LWB
1	'Tween deck.....	28	27	23	12	8
	Lower hold.....	28	24	18	10	5
	On deck.....	41	36	20	13	8
2	'Tween deck.....	54	44	30	21	12
	Lower hold.....	48	42	*30	*18	12
	On deck.....	22	14	10	6	4
3	'Tween deck.....	36	28	25	14	6
	Lower hold.....	32	28	*22	*12	6
	On deck.....	31	20	16	11	8
4	'Tween deck.....	41	37	27	16	8
	Lower hold.....	20	15	18	10	2
	On deck.....	31	22	14	11	6
5	'Tween deck.....	44	34	25	16	9
	Lower hold.....	20	11	20	6	2
	On deck.....	14	12	6	5	4

* Based on no centerline bulkhead, which may or may not be standard equipment.

Victory Ship*						
1	2	3	4	5	6	7
Hatch No.	Location	Trucks, utility, ¼-ton	Trailers, cargo, 1½-ton	Trucks, cargo, ¾-ton	Trucks, cargo, 2½-ton, 6 x 6, LWB	Trucks, cargo, 5-ton, 6 x 6, LWB
1	Upper 'tween deck.....	15	16	9	5	0
	Lower 'tween deck.....	16	18	9	6	3
	Hold.....	15	13	8	4	3
	On deck.....	18	16	12	7	4
2	Upper 'tween deck.....	29	26	17	10	4
	Lower 'tween deck.....	25	24	17	10	5
	Hold.....	21	21	14	8	3
	On deck.....	25	29	18	13	8
3	Upper 'tween deck.....	48	48	29	17	12
	Lower 'tween deck.....	46	46	30	18	12
	Hold.....	44	46	30	18	8
	On deck.....	23	25	18	13	8
4	'Tween deck.....	49	48	34	16	14
	Hold.....	49	49	31	18	13
	On deck.....	25	25	17	6	4
5	'Tween deck.....	30	31	20	12	6
	Hold.....	20	19	12	7	3
	On deck.....	20	14	13	7	4

* There are no available aircraft data for the Liberty, Victory, and C1 B ships, since their holds are not adaptable to plane stowage; consequently, they were seldom used for this purpose.

C1 M AV 1

1	2	3	4	5	6	7
Hatch No.	Location	Trucks, utility, ¼-ton	Trailers, cargo, 1½-ton	Trucks, cargo, ¾-ton	Trucks, cargo, 2½-ton, 6 x 6, LWB	Trucks, cargo, 5-ton, 6 x 6, LWB
1	'Tween deck.....	30	23	16	10	3
	Hold.....	16	13	7	4	2
	On deck.....	30	24	18	10	8
2	'Tween deck.....	51	46	28	19	10
	Hold.....	51	45	28	19	10
	On deck.....	28	22	14	10	6
3	'Tween deck.....	44	37	27	17	9
	Hold.....	44	37	26	15	9
	On deck.....	20	20	11	7	4

Mariner

1	2	3	4	5	6	7
Hatch No.	Location	Trucks, utility, ¼-ton	Trailers, cargo, 1½-ton	Trucks, cargo, ¾-ton	Trucks, cargo, 2½-ton, 6 x 6, LWB	Trucks, cargo, 5-ton, 6 x 6, LWB
1	Upper 'tween deck.....	20	16	12	6	4
	Lower 'tween deck.....	14	10	9	4	0
	Hold.....	9	5	6	3	0
	On deck.....	33	23	20	10	7
2	Upper 'tween deck.....	37	23	22	11	7
	Lower 'tween deck.....	26	21	15	9	7
	Hold.....	15	11	9	5	2
	On deck.....	52	42	30	20	10
3	Upper 'tween deck.....	61	48	38	25	13
	Lower 'tween deck.....	52	44	32	21	13
	Hold.....	36	32	22	14	9
	On deck.....	52	36	26	18	10
4	Upper 'tween deck.....	69	46	38	20	14
	Lower 'tween deck.....	69	46	38	20	14
	Hold.....	56	44	30	16	12
	On deck.....	54	36	28	20	12
5	Upper 'tween deck.....	72	56	42	18	14
	Lower 'tween deck.....	74	58	44	¹ 18	¹ 14
	Hold.....	72	56	42	¹ 16	¹ 12
	Deep tank.....	36	28	14	6	2
6	On deck.....	54	40	30	20	12
	'Tween deck.....	65	47	36	18	14
	Hold.....	34	30	20	12	9
	Deep tank.....	10	4	0	0	0
7	On deck.....	37	27	22	12	7
	'Tween deck.....	42	33	23	11	7
	Hold.....	10	9	6	4	0

¹ On nonrefrigerated type only. Approximately three 5-tons or four 2½-tons can be loaded in these decks on refrigerated type vessels.

Note. The figures contained in the preceding charts reflect general loading conditions and by no means represent the maximum vehicle capacities of the type vessels. With the exception of crated vehicles, no allow-

ance has been made for stacking or double-decking. All below-deck stowage is fore and aft, except in the case of ¼-ton trucks and 1½-ton trailers, which are stowed both fore and aft and athwartship.

7.55. Approximate Sailing Distances in Nautical Miles

Ports	Ports of embarkation						
	Boston	New York	Charleston	New Orleans	Los Angeles	San Francisco	Seattle
<i>United States</i>							
Boston.....		200	900	2,000	1 5,100	1 5,400	1 6,200
New York.....	200		600	1,700	1 4,900	1 5,300	1 6,000
Charleston.....	900	600		1,200	1 4,500	1 4,900	1 5,600
New Orleans.....	2,000	1,700	1,200		1 4,300	1 4,700	1 5,500
Los Angeles.....	1 5,100	1 4,900	1 4,500	1 4,300		400	1,100
San Francisco.....	1 5,400	1 5,300	1 4,900	1 4,700	400		800
Seattle.....	1 6,200	1 6,000	1 5,600	1 5,500	1,100	800	
<i>North Atlantic</i>							
Newfoundland, St. Johns.....	900	1,100	1,700	2,600	1 5,700	1 6,000	1 6,800
Greenland, Ivigtut.....	1,700	1,900	2,400	3,400	1 6,500	1 6,800	1 7,600
Iceland, Reykjavik.....	2,300	2,500	3,000	4,000	1 7,100	1 7,400	1 8,200
<i>European</i>							
United Kingdom:							
Liverpool.....	3,000	3,200	3,700	4,700	1 7,600	1 7,900	1 8,700
Southampton.....	3,000	3,200	3,600	4,600	1 7,500	1 7,800	1 8,600
Northern Ireland, Belfast.....	2,900	3,000	3,400	4,400	1 7,200	1 7,500	1 8,300
Norway, Oslo.....	3,900	4,100	4,400	5,300	1 8,200	1 8,600	1 9,400
Russia:							
Archangel.....	4,000	4,200	4,800	5,800	1 8,800	1 9,200	1 10,000
Murmansk.....	3,700	3,800	4,400	5,400	1 8,500	1 8,900	1 9,700
France:							
Le Havre.....	3,000	3,200	3,600	4,600	1 7,500	1 7,800	1 8,600
Brest.....	2,900	3,100	3,500	4,500	1 7,400	1 7,700	1 8,500
Bordeaux.....	3,000	3,200	3,700	4,700	1 7,600	1 7,900	1 8,700
Belgium, Antwerp.....	3,200	3,400	3,800	4,800	1 7,700	1 8,000	1 8,800
<i>Mediterranean</i>							
France, Marseille.....	2 3,700	2 3,900	2 4,300	2 5,300	1 8,000	1 8,200	1 9,000
Italy, Naples.....	2 4,000	2 4,200	2 4,600	2 5,600	1 8,300	1 8,500	1 9,300
Algeria, Algiers.....	2 3,400	2 3,600	2 4,000	2 5,000	1 7,700	1 8,000	1 8,800
St. of Gibraltar.....	3,000	3,200	3,600	4,600	1 7,300	1 7,500	1 8,300
<i>Caribbean and South Atlantic</i>							
Bermuda, Hamilton.....	700	700	800	1,700	1 4,600	1 4,900	1 5,800
Puerto Rico, San Juan.....	1,500	1,400	1,100	1,500	1 3,900	1 4,300	1 5,100
Trinidad, Port of Spain.....	2,000	1,900	1,700	2,100	1 4,100	1 4,400	1 5,300
Brazil, Rio de Janeiro.....	4,700	4,800	4,700	5,200	1 7,200	1 7,600	1 8,400
Argentina, Buenos Aires.....	5,800	5,900	5,800	6,300	1 8,300	1 8,700	1 9,600
Panama Canal, Panama.....	2,200	2,000	1,600	1,400	2,900	1 3,200	4,000
<i>Middle East</i>							
Egypt, Port Said.....	2 4,900	2 5,100	2 5,500	2 6,500	1 9,200	1 9,500	1 10,300
Arabia, Aden.....	2 6,300	2 6,500	2 6,900	2 7,900	1 10,600	1 10,900	1 11,700
Turkey, Istanbul.....	2 4,800	2 5,000	2 5,400	2 6,400	1 9,100	1 9,400	1 10,200
Iran, Khorramshahr (Persian Gulf).....	2 8,300	2 8,500	2 8,900	2 9,800	1 12,600	1 12,900	1 13,700
<i>North Pacific</i>							
Alaska, Dutch Harbor.....	1 7,400	1 7,300	1 6,900	1 6,700	2,400	2,100	1,700

See footnotes at end of table.

Ports	Ports of embarkation						
	Boston	New York	Charleston	New Orleans	Los Angeles	San Francisco	Seattle
<i>Middle Pacific</i>							
Hawaiian Islands, Honolulu-----	¹ 6,900	¹ 6,700	¹ 6,300	¹ 6,100	2,200	2,100	2,400
Marshall Islands, Kwajalein-----	¹ 9,200	¹ 9,000	¹ 8,600	¹ 8,400	4,200	4,410	4,500
Marianas Islands, Guam-----	¹ 10,200	¹ 10,000	¹ 9,600	¹ 9,400	5,600	5,100	4,900
Japan, Yokohama-----	¹ 9,900	¹ 9,600	¹ 9,500	¹ 9,100	4,800	4,500	4,200
<i>Southwest Pacific</i>							
New Guinea, Finschhafen-----	¹ 10,200	¹ 10,000	¹ 9,600	¹ 9,400	6,100	5,900	6,000
Philippine Islands, Manila-----	¹ 11,600	¹ 11,300	¹ 11,000	¹ 10,800	6,600	6,300	6,100
Australia:							
Brisbane-----	¹ 9,900	¹ 9,600	¹ 9,300	¹ 9,100	6,300	6,200	6,500
Melbourne-----	¹ 10,100	¹ 9,900	¹ 9,500	¹ 9,400	7,000	7,000	7,300
East Indies, Singapore-----	² 9,900	¹ 10,100	² 10,500	² 11,500	7,900	7,500	7,100
<i>China-India-Burma</i>							
China:							
Shanghai-----	¹ 10,800	¹ 10,600	¹ 10,200	¹ 10,000	5,700	5,400	5,100
Hongkong-----	¹ 11,400	¹ 11,200	¹ 10,800	¹ 10,600	6,400	6,000	5,700
India:							
Bombay-----	² 8,000	² 8,200	² 8,600	² 9,500	^{1 2} 12,200 10,300	^{1 2} 12,600 9,900	^{1 2} 13,400 9,500
Calcutta-----	² 9,600	² 9,800	² 10,200	² 11,200	^{1 2} 13,900 9,500	^{1 2} 14,200 9,100	^{1 2} 15,000 8,700
Burma, Rangoon-----	² 9,600	² 9,800	² 10,200	² 11,200	^{1 2} 13,900 9,000	^{1 2} 14,200 8,600	^{1 2} 15,000 8,200
East Russia, Vladivostok-----	¹ 9,500	¹ 9,300	¹ 8,900	¹ 8,700	5,000	4,600	4,400

¹ Via Panama Canal.

² Via Strait of Gibraltar.

7.56. Shipping Turnaround Times

a. *General.* Turnaround time for similar type ships seldom will be the same between two ports, or other equidistant runs, unless sailings are carefully controlled. Assuming controlled operating conditions, a basis for turnaround times can be established for type ships (troop or cargo) for general planning purposes.

b. *Turnaround Time Components.* Turnaround time components are—

- (1) Loading time at home port.
- (2) Steaming time to and from destination.
- (3) Unloading and loading time at destination.
- (4) Unloading time at home port.
- (5) Normal voyage repair and reoutfitting time.

c. Planning Factors.

(1) Sailing distances per day*

(a) Cargo ships.

1. Slow—240 nautical miles.
2. Fast—360 nautical miles.

(b) Passenger ships.

1. Slow—360 nautical miles.
2. Fast—432 nautical miles.

(2) Time in ports per round trip for unloading, loading, voyage repairs, and reoutfitting.

(a) Cargo ships—35 days.

(b) Troop ships—20 days.

(c) Tankers—10 days.

(3) Convoys and effect on turnaround time. A major portion of shipping may be conducted in convoy formation, the speed of which is dictated by the

*For convoy sailing speed of advance deduct 10 percent for delays in forming convoys, zigzagging on route, etc. The 10 percent loss factor is not applicable to ships in the "fast" category since such ships will normally proceed individually.

slowest vessel in each convoy. This factor must be considered when com-

puting turnaround time for convoy or escorted shipping.

d. Table.

Ports	Ports of embarkation*													
	Boston		New York		Charleston		New Orleans		Los Angeles		San Francisco		Seattle	
	Type of shipping													
	Troop	Cargo	Troop	Cargo	Troop	Cargo	Troop	Cargo	Troop	Cargo	Troop	Cargo	Troop	Cargo
<i>United States</i>														
Boston.....									48	72	50	74	54	82
New York.....									46	70	49	74	53	80
Charleston.....									45	67	47	71	51	77
New Orleans.....									44	67	46	69	51	77
Los Angeles.....	48	72	46	70	45	67	44	67						
San Francisco.....	50	74	49	74	47	71	46	69						
Seattle.....	54	82	53	80	51	77	51	77						
<i>North Atlantic</i>														
Newfoundland, St. John.....			27	40	30	45	36	53	55	82	57	85	61	92
Greenland, Ivigtut.....	30	45	31	47	35	52	41	61	60	89	62	92	66	100
Iceland, Reykjavik.....	34	50	35	52	38	57	44	67	63	95	65	97	70	106
<i>European</i>														
United Kingdom:														
Liverpool.....	38	57	39	59	43	64	49	73	66	100	68	102	73	110
Southampton.....	38	57	39	59	42	63	48	72	66	99	68	102	72	109
Northern Ireland, Belfast.....	38	56	38	57	41	61	47	70	64	96	66	99	71	106
Norway, Oslo.....	44	66	45	68	47	70	52	78	70	105	72	109	77	116
Russia:														
Archangel.....	44	67	46	69	49	74	55	83	73	111	76	114	81	122
Murmansk.....	43	64	43	65	47	70	53	80	72	108	74	112	79	119
France:														
Le Havre.....	38	57	39	59	42	63	48	72	66	99	68	102	72	109
Brest.....	38	56	39	58	41	62	48	71	65	97	67	101	72	108
Bordeaux.....	38	57	39	59	43	64	49	73	66	100	68	102	73	110
Belgium, Antwerp.....	39	59	41	61	43	65	49	74	67	101	69	103	73	111
<i>Mediterranean</i>														
France, Marseille.....	43	64	44	66	46	69	52	78	69	103	70	106	75	113
Italy, Naples.....	44	67	46	69	48	72	54	81	71	106	72	108	77	115
Algeria, Algiers.....	41	61	42	63	44	67	50	76	67	101	69	103	73	111
Strait of Gibraltar.....	38	57	39	59	42	63	48	72	65	97	66	99	71	106
<i>Caribbean and South Atlantic</i>														
Bermuda, Hamilton.....							30	45	48	72	50	75	55	83
Puerto Rico, San Juan.....	29	44	28	42	27	40	29	44	44	66	46	69	50	76
Trinidad, Port of Spain.....	32	48	31	47	30	45	33	49	45	68	47	70	52	78
Brazil, Rio de Janeiro.....	49	73	49	74	49	73	51	78	64	96	66	100	71	107
Argentina, Buenos Aires.....	55	83	56	84	55	83	59	88	71	106	73	110	78	118
Panama, Panama Canal.....	33	48	32	48	30	45	28	42	38	56	39	59	44	67

See footnotes at end of table.

Ports	Ports of embarkation*													
	Boston		New York		Charleston		New Orleans		Los Angeles		San Francisco		Seattle	
	Type of shipping													
	Troop	Cargo	Troop	Cargo	Troop	Cargo	Troop	Cargo	Troop	Cargo	Troop	Cargo	Troop	Cargo
<i>Middle East</i>														
Egypt, Port Said.....	50	75	50	76	54	80	60	89	76	114	78	117	83	124
Arabia, Aden.....	51	78	60	89	62	93	68	102	85	127	86	130	92	137
Turkey, Istanbul.....	49	74	50	76	53	80	59	89	76	113	77	116	82	124
Persia, Basra.....	71	106	72	108	73	110	80	120	97	145	99	147	104	155
<i>North Pacific</i>														
Alaska, Dutch Harbor.....	65	97	65	97	62	93	61	91	35	52	33	49	30	45
<i>Middle Pacific</i>														
Hawaiian Islands, Honolulu.....	62	93	61	91	59	88	57	86	33	48	33	49	35	52
Marshall Islands, Kwajalein.....	76	114	75	113	72	109	71	107	46	69	47	70	48	71
Marianas, Guam.....	82	124	81	122	78	118	77	116	54	81	50	76	50	75
Japan, Yokohama.....	80	121	79	118	78	117	76	113	49	74	48	71	46	69
<i>Southwest Pacific</i>														
New Guinea, Finschhafen.....	82	124	81	122	78	118	77	116	57	86	56	84	57	85
Philippines, Manila.....	91	136	89	133	87	131	86	129	60	90	59	88	57	86
Australia:														
Brisbane.....	80	121	78	118	77	115	76	113	59	88	58	87	60	89
Melbourne.....	82	123	80	121	78	117	77	116	62	94	62	94	65	97
East Indies, Singapore.....	80	121	82	123	83	126	90	134	68	102	66	99	63	95
<i>China-India-Burma</i>														
China:														
Shanghai.....	86	129	85	127	82	124	81	122	55	82	53	80	50	76
Hongkong.....	90	135	88	132	86	129	85	127	59	89	57	85	55	82
India:														
Bombay.....	69	103	70	106	72	109	78	117	94	142	97	145	102	153
Calcutta.....	79	118	80	120	82	124	88	132	83	124	80	121	78	117
Burma, Rangoon.....	79	118	80	120	82	124	88	132	78	117	76	113	73	110
East Russia, Vladivostok.....	78	117	77	115	74	112	73	110	165	157	108	160	112	167
									75	113	72	109	70	106
									50	76	48	72	47	70

* All turnaround times are based on the routes indicated in the table in paragraph 7.55 and on data given in c above. The turnaround times between ports, with the exception of inter-US port times, include a 10 percent safety factor for forming convoy zigzagging, etc.

Section X. MISCELLANEOUS TRANSPORT

7.57. General

There are other means of transportation which are relatively less important than pipeline, water, rail, highway, and air transporta-

tion in the overall picture of transportation, but all have peculiar characteristics which are adaptable to special situations as indicated in paragraphs 7.58-7.61. For this reason, planners should not underestimate their value.

7.58. Characteristics of Cableways and Tramways

Type	Employment	Maximum length (feet)	Carriers			Construction effort	Transportation required
			Description	Capacity each (lb)	Speed		
Engineer medium cableway.	Transports materiel and personnel over a single ravine, gorge, or gully.	1,200	1 weighted fall block.	3,000	550 feet per minute.	2 engineer platoons—1 on each bank—can erect a cableway across a 1,000-foot gap in 4 hours.	Four 2½-ton cargo trucks or fourteen ¾-ton cargo trucks.
Engineer light aerial tramway, M2.	Transports materiel and personnel over slopes up to 35° from the horizontal and spans streams and ravines that lie across its route.	3,000	2 cargo platforms, 3' 6" x 1' 11¼" and 2 litter platforms, 6' 4" x 1' 11¼".	350	400 feet per minute.	An engineer company can construct a 3,000-foot tramway in 24 hours.	Four 2½-ton cargo trucks, twelve ¾-ton cargo trucks, thirty-five ¼-ton trailers, thirty-five ¼-ton trucks, or 100 pack mules.
Engineer light pioneer aerial tramway and cableway, M1.	Transports materiel and personnel over terrain inaccessible or difficult for other means of transportation. Can be used as a cableway to cross a single ravine, gorge, or gully; as a tramway to traverse slopes up to 35° from the horizontal; or as a toboggan hauling unit for operation either on snow or smooth ground.	Tramway—2,000; cableway—1,500.	6 platforms 3'6" x 2' (or 3 platforms 7' x 2'), and 2 plywood toboggan sleds 8' x 2' 4".	Tramway—350; cableway and toboggan—2,000.	Tramway—310 feet per minute; cableway and toboggan—580 feet per minute.	2 engineer platoons can erect a 2,000-foot tramway in 8 to 12 hours. 1 engineer platoon can erect a 1,500-foot cableway in 5 hours.	One 2½-ton cargo truck, four ¾-ton cargo trucks, nine ¼-ton trailers, nine ¼-ton trucks and one ¼-ton trailer, or 35 pack mules.
Transportation heavy aerial tramway.	Transports supplies and equipment from shipside in the stream to an inland terminal point; may also be used over terrain inaccessible to other means of transportation and to span ravines, gorges, and gullies not exceeding 700 feet in width.	Unlimited.	6 cars (2 in reserve to provide necessary maintenance factor) each powered by a 180-HP gasoline engine and equipped with hoist and cargo platform.	20,000	10 miles per hour loaded.	For planning purposes, an engineer port construction company normally requires approximately ten 20-hour days (6,000 man-hours) to erect a basic 1-mile tramway system. This figure will be increased considerably, however, under adverse conditions of weather and terrain, the latter being the most critical factor.	One transportation medium truck company (S&P) and four 40-foot lowbed trailers.*

* Entire system can be transported by water on spud barges organic to the tramway company.

7.59. Pack Animals

a. *Employment.* Pack mules may be employed to transport light cargo over terrain which is impassable for motor transport.

b. *Characteristics and Capabilities.*

- (1) *Height*—59 to 62 inches.
- (2) *Weight*—1,000 to 1,200 pounds.
- (3) *Rate of march*—4 to 5 miles in the hour.
- (4) *Cargo load*—200 to 250 pounds.
- (5) *Movement of casualties*—1 litter or 2 sitting casualties.
- (6) *Forage*—10 pounds of oats and 14 pounds of hay per day. May be reduced for short periods up to 10 days without impairing capacity.
- (7) *Water*—10 gallons per day.
- (8) *Average daily distance.*
 - (a) Mountainous terrain—12 miles.
 - (b) Rolling or flat terrain—20 miles.
- (9) *Gradability:*
 - (a) Rate of ascent—1,650 vertical feet per hour.
 - (b) Rate of descent—1,000 vertical feet per hour.
- (10) *Noneffective rate*—32 per 1,000 mules.

c. *Transportability.*

Vehicle	Capacity (horses or mules)
Truck, $\frac{3}{4}$ -ton, cargo, 4 x 4	2
Truck, $2\frac{1}{2}$ -ton, cargo	4
Semitrailer, 6-ton, combination animal and cargo	8
Railroad stock car, 40-foot	25 (approximate)
Railroad stock car, 36-foot	20 to 22 (approximate)
Airplane, transport	4 to 6
(May be transported at altitudes up to 18,000 feet with no ill effects.)	

d. *Horse-Drawn Carts.* Capable of traveling 20 miles in the day and sustaining a payload of 1,000 pounds.

7.60. Sled Trains

a. *General.* The mission of a sled train is to furnish oversnow and overice movement of supplies, equipment, and personnel. Sled trains will be employed when more efficient means of transportation are not feasible.

b. *Planning Factors.*

- (1) *Capability of tractor prime movers.* For planning purposes, the ideal load for tractors, based upon their drawbar pull and allowing sufficient reserve power, is as follows:

	1	2	3
1	Class	Net weight (pounds)	Load
2	Tractor, crawler-type, diesel engine-driven, 12,001—17,000 pounds, drawbar pull.	10,709	2 loaded 10-ton sleds plus 1 wanigan.
3	Tractor, crawler-type, diesel engine-driven, 17,001—24,000 pounds, drawbar pull.	17,667	3 loaded 10-ton sleds plus 1 wanigan.
4	Tractor, crawler-type, diesel engine-driven, 24,001—32,000 pounds, drawbar pull.	25,470	4 loaded 10-ton sleds plus 1 wanigan.
5	Tractor, crawler-type, diesel engine-driven, 32,001—40,000 pounds, drawbar pull.	36,553	6 loaded 10-ton sleds plus 1 wanigan.

Note. Not used when traveling over unprepared trails or cross country.

- (2) *Payload capacity.* Providing that well-marked trails are used, weather delays will be encountered, and malfunctioning equipment will be dropped for later recovery, the cargo-hauling capabilities of 5 tractor sled trains (D7 LGP) on 100- and 200-mile destination trips are as follows:

	1	2	3
1		200 miles round trip	400 miles round trip
2	Fuel per tractor—2.1 GPM × miles (round trip).	420 gal	840 gal
3	Gal per tractor × 5 tractors	2,100 gal	4,200 gal
4	Safety margin 15 percent—	315 gal	630 gal
5	Total gal-----	2,415 gal	4,830 gal
6	Total gal × 7 lb per gal (bulk diesel).	16,905 lb	33,810 lb
7	Lube, alcohol, antifreeze— 20 lb per tractor per 100 miles of operation.	200 lb	400 lb
8	Planning factor travel time at 60 miles per day.	4 days	7 days
9	Rations—19 crewmen × 10 lb per day × number of days (include 1 day emergency).	950 lb	1,520 lb
10	Fuel for 2 stoves (cook and heat), oil or coal (100 lb each per day).	800 lb	1,400 lb
11	Fuel for electric generator (5 gal per tractor per day).	140 lb	245 lb
12	Fuel for personnel heaters (3 gal per tractor per day).	420 lb	735 lb
13	Survival equipment-----	400 lb	400 lb
14	Tools and repair parts-----	2,000 lb	2,500 lb
15	Total domestic load---	21,815 lb 10.9 short tons	41,010 lb 20.5 short tons
16	Gross capacity 14 sleds at 7.5 short tons.	98 short tons	98 short tons
17	Payload capacity-----	87.1 short tons	77.5 short tons

c. *Transportation Cargo Carrier Company (Tracked) (TOE 55-27)*. See part II, FM 101-10. (When published).

7.61. Human Bearers

a. *General*. Human bearers consist of natives or other personnel used for the transportation of personnel and/or supplies. Their use is generally limited to those situations where other means are impractical or not available.

b. *Planning Data*. For planning purposes, the following may be assumed:

(1) *Cargo loads*.

(a) Male bearer—80 pounds average load.

(b) Female bearer—30 to 35 pounds average load.

(2) *Personnel loads*—8 to 12 bearers per litter team (for continuous operation).

(3) *Rate of march*—12 miles in the day under average conditions.

(4) Overloading and speedup of operations cause desertions and increase the sick rate.

(5) *Noneffective rate*—approximately 30 percent.

(6) Close supervision required to prevent pilferage.

CHAPTER 8

LOGISTICS—SERVICE

Section I. GENERAL

8.1. Coverage

This section contains information of and measurement factors involved in the services other than supply.

8.2. Cross References

a. Troop requirements for all services are found in paragraphs 4.1 through 4.6 and in FM 101-10, part II (when published).

b. Tactical signal communication is covered in paragraphs 4.20 through 4.26.

c. Field engineering is covered in paragraphs 4.27 through 4.34.

d. Characteristics of materiel of all services are covered in chapter 5.

8.3. Base Development

a. *General.* Base development is the improvement and expansion of the resources of an area to support military operations. Its purpose is to provide the facilities necessary for the logistical and administrative support of combat forces in accordance with strategic war plans.

b. *Phases of Base Development.*

(1) *Assault and consolidation.* This is the period for the assault and consolidation by the combat forces in the objective area. Some elements of the base command are attached to tactical units and arrive early in the operation to assist in initiating base development.

(2) *Exploitation.* This period covers the time between the establishment of the combat forces in the objective area and the time that tactical operations have progressed to such a degree that the base area is relatively secure from ground attack.

(3) *Development.* This is the principal period for base development. It extends from the time the base area is relatively secure from ground attack until the cessation of tactical operations or until rollup begins.

c. *Logistical Requirements for Base Develop-*

ments. Logistical requirements for the three phases of base development vary widely. During the assault and consolidation phase, logistical requirements are characteristic of those peculiar to amphibious or airborne operations (see TT 57-100-30, *Airborne Division and Airborne Operation*). During the exploitation phase, requirements become progressively more stable, centralized, and predictable. In the development phase, installations are completed, streamlined, and balanced to produce an efficient flexible operating base.

d. *Base Development Plan.* The efficient development and operation of bases require early and thorough planning, which culminates in the base development plan. This is a detailed plan which—

- (1) Establishes responsibilities of the various Services (Army, Navy, Air Force); construction policies, priorities, and fixed dates by which essential facilities will be operational.
- (2) Allocates real estate and existing facilities to agencies and installations in the manner best suited to the efficient construction and operation of the base.
- (3) Provides a basis for determination of materiel requirements, preparation of projects or requisitions, and shipment of supplies to construct and operate the base.
- (4) Forms a basis for allocation of available shipping capacity among various claimants.
- (5) Provides a basis for the number, kind, and dates of arrival of necessary construction and operating troops.

e. *Logistical Data for Base Development.* Data applicable to initial base development planning in its various phases are found throughout this manual. Data pertaining to major base development tasks are found in the following locations:

- (1) Storage — paragraphs 5.57 through 5.67.

- (2) Hospital bed requirements — paragraphs 6.6 through 6.9.
- (3) Transportation — paragraphs 7.1 through 7.61.

- (4) Construction—paragraphs 8.4 through 8.13.
- (5) Communications — paragraphs 4.20 through 4.26.

Section II. CONSTRUCTION

8.4. Engineer Construction Troops

a. Battalion Month. One battalion month is the construction effort of an average experienced and properly equipped engineer construction battalion during 1 month of time. For general estimates, the battalion month represents 100,000 man-hours of construction effort. (See par. 8.12a(2) and b.)

b. Force Estimates. The force estimates outlined herein are based on average conditions encountered in the various theaters during World War II. They should be used only as a general planning guide and should be modified for known or expected conditions of particular operations.

c. Unit Equivalents. It is not practicable to state an average factor for construction effort of the various other engineer units, based on the battalion-month yardstick, as defined in *a* above, which will be applicable to all types of construction projects. The quantity and type of equipment assigned to the unit and its training are important factors in determining its effectiveness on a particular type of construction work. For example, an engineer combat battalion would be more effective than an engineer construction battalion in the repair of roads in a combat zone (average factor 1.3), but an engineer combat battalion would be much less effective than an engineer construction battalion in the construction of a new road in the communications zone, requiring considerable earthmoving (average factor 0.6). The factors listed in the table below are based on the assumption that, in general, the average construction project in a combat zone requires much less heavy engineer equipment than the average construction project in a communications zone. The factors apply only to properly equipped engineer units of average experience. They should be used only in broad planning and do not apply to any one particular construction project. The many factors involved make it advisable that an experienced engineer officer,

familiar with the technical details of a particular project, determine the type of engineer unit to be assigned to its construction, whenever practicable.

	1	2	3
1	Unit	Average construction effort factor	
		Combat zone	Communications zone
2	Engr cons bn.....	1.0	1.0
3	Engr combat bn.....	1.3	.6
4	Engr hv cons bn.....	.9	1.2
5	Engr combat bn plus lt eqp co....	1.4	.9
6	Engr cons bn plus hv eqp co....	1.2	1.4

8.5. Roads

a. Road Nets.

- (1) Construction and maintenance of roads in a theater of operations is held to the minimum required by the situation and is based on maximum use of the existing road net. The capacity of roads of various types, in short tons forward per day, is given in paragraph 7.15.
- (2) Normally the minimum two-lane road nets to be provided and maintained are as follows:
 - (a) In the combat zone—
 1. One earth road per frontline division forward of division rear boundary.
 2. Two improved (gravel, crushed rock, etc.) roads per corps forward of army rear boundary.
 3. Lateral improved roads at 10-mile intervals in rear of division rear boundary.
 4. Access roads as required at depots, supply points, and other installations in corps rear and army service areas.

(b) In the communications zone—

1. Two bituminous surface-treated roads to each army service area. Connecting roads as required to ports and beaches.
2. Access roads as required at depots and other installations in the communications zone.

b. *New Construction of Roads.*

- (1) *Construction policy.* New road construction is undertaken only when absolutely necessary, and normally it includes only such items as detours to bypass demolitions and access roads. The factors listed in the tables in (3) through (8) below are given primarily for estimating rehabilitation as a percentage of the requirements for new construction.

- (2) *Bridge and culvert requirements.* For planning purposes, it is assumed that 1 mile of new road requires 40 lineal feet of bridging and 7 culverts.

- (3) *Material requirements for one mile of new road* (including bridges, culverts, asphalt, and cement for concrete pavement). This table does not include gravel or crushed rock requirements, which are given in table in (4) below.

Type of road	Single-lane 12-ft wide		Double-lane 22-ft wide	
	Short tons	Meas tons	Short tons	Meas tons
Earth.....	39	42	60	65
Gravel or crushed rock, 6-in.	47	58	97	110
Asphalt palliative.....	53	61	107	125
1-in. asphalt surface.....	61	87	123	158
2-in. asphalt surface.....	75	110	142	195
3-in. asphalt surface.....	82	121	154	221
Concrete, 6-in. surface....	315	205	602	312

Note. Bridging as in b(6) below, except that bridging for earth roads, is estimated at 75 percent timber and 25 percent steel stringers on wood substructures.

(4) *Gravel or crushed rock requirements for one mile of new road.*

1	Type of road	1	2	3	4	5
		Surface 12 feet wide		Surface 22 feet wide		
		Cubic yards	Short tons	Cubic yards	Short tons	
2	Surface 4" thick ¹ ----	782	1,173	1,434	2,151	
3	Surface 5" thick ¹ ----	978	1,446	1,793	2,690	
4	Surface 6" thick ¹ ----	1,174	1,761	2,151	3,226	
5	3" asphalt surface----	587	881	1,076	1,614	
6	4" concrete surface---	782	1,174	1,434	2,151	
7	6" concrete surface---	1,173	1,761	2,151	3,226	

¹ Based on loose thickness. For compacted thickness, add 25 percent.

- (5) *Corrugated metal culvert pipe requirements per mile of road.* (Based on average length of 36 feet per culvert for 1-lane roads, 56 feet per culvert for 2-lane roads, and 7 culverts per mile.)

	1	2	3	4	5	6	7	8	9
1		Size, inches, diameter	Percentage	Surface 12 feet wide			Surface 22 feet wide		
				Linear feet	Weight, pounds	Cubic feet	Linear feet	Weight pounds	Cubic feet
2	Average quantities for culvert.....	18	15	4.5	72	1.22	8.4	134	2.27
3	-----	24	25	7.5	157	2.78	14.0	294	5.18
4	-----	36	30	9.0	333	7.38	16.8	629	13.94
5	-----	42	7	2.1	134	2.31	3.9	256	4.40
6	-----	48	15	4.5	324	6.35	8.4	605	11.84
7	-----	60	8	2.4	264	6.00	4.5	495	11.25
8	Total.....		100	30.0	1,284	26.04	56.0	2,413	48.88
9	Quantities per mile.....			210.0	8,988	182.28	392.0	16,891	342.16
10	-----	Short tons.....			4.22			8.17	
11	-----	Measurement tons.....			4.25			8.78	
12	-----	Man-hours.....			1,260			1,960	

(6) *Fixed-bridge requirements per mile of road.* (Based on 40 lineal feet of bridging per mile of route and on

average percentages of the various types of standard military bridging spans.¹)

	1	2	3	4	5	6	7	8	9
1	Type of span	Percentage	Lineal feet	One-lane		Two-lane			
				Short tons	Measure-ment tons	Man-hours	Short tons	Measure-ment tons	Man-hours
2	Timber, 14-20 ft ² -----	30	12	9.20	10.82	110	14.33	16.84	180
3	I-beam, set, 30 ft, 4-24 in., WF beams ³ -----	25	10	10.04	11.70	210	20.08	21.97	450
4	I-beam, set, 60 ft, 4-33 in., WF beams ³ -----	15	6	8.70	9.00	200	17.10	16.20	400
5	Pony truss, 90 ft, steel ³ -----	5	2	2.90	3.50	80	4.98	6.67	130
6	Steel stringers, 20-90 ft span-----	13	4	4.46	4.28	120	6.28	5.73	180
7	Bailey, through truss, DD, 130 ft-----	12	6	7.75	14.34	100	25.38	28.85	270
8	Total-----	100	40	43.05	53.64	820	89.05	96.26	1,610

¹ These data are based on timber and wood pile substructures. If the planning includes steel trestle piers for 60- to 150-foot spans, add 0.500 short ton, 0.375 measurement ton, and 7½ man-hours per lineal foot of 1-lane bridge. Double these quantities for 2-lane bridge.

² Timber bridge data are based on typical timber bridging with 15-foot wood stringers. See TM 5-286.

³ Semipermanent steel highway bridging is described in TM 5-285.

(7) *Highway bridge construction, fixed bridging.* (Types, capacities, and

references.)

	1	2	3		4
1	Type	Span	Capacities		References
			Design	With caution	
2	I-beam.....	30-foot.....	Class 50.....	Class 60 ¹	TM 5-285, 5-286, 5-260.
3	I-beam.....	60-foot.....	Class 50.....	Class 60 ¹	TM 5-285, 5-286, 5-260.
4	Pony truss.....	90-foot.....	Class 50.....	Class 50.....	TM 5-285, 5-286, 5-260.
5	Steel stringers.....	20- to 90-foot.....	Class 50.....	Class 80 ²	TM 5-286.
6	Bailey.....	30- to 180-foot.....	Class 10-80 ²	Class 55-100 ³	TM 5-277, 5-286.

¹ Class 70 loading may be carried if intermediate support is provided.

² Controlled single-lane traffic over double-lane bridges.

³ Varies with type and span length. See TM 5-277.

(8) *Construction effort.* Net effective man-hours of engineer construction troops required for grading and surfacing 1 mile of new road to the fol-

lowing standards: 1-lane road (12-foot traffic lanes plus 4-foot shoulders); double-lane road (22-foot traffic lane plus 4-foot shoulders).^{1 2}

1	Terrain	One-lane			Double-lane		
		Grading only	Grading and 6-in. gravel	Grading, 6-in. gravel and 3-in. asphalt	Grading only	Grading and 6-in. gravel	Grading, 6-in. gravel and 3-in. asphalt
2	Flat prairie.....	2,500	3,300	12,500	3,500	4,800	18,800
3	Rolling.....	3,400	4,200	13,500	4,000	5,400	19,400
4	Hilly, forested.....	4,700	5,600	14,750	5,500	7,000	21,000
5	Mountain, forested, no rock.....	8,400	9,300	18,500	22,000	27,000	42,000
6	Mountain, some rock.....	14,000	19,500	28,500	36,500	45,500	59,500
7	Mountain, heavy rock.....	26,500	32,000	41,500	70,000	79,000	93,000

c. Road Rehabilitation. Materials and effort required to rehabilitate roads after action, in percentages of the materials and effort required for new construction.

1	Rehabilitation of—	2 Equivalent percentages of new construction (percentage)
2	Roads.....	10 to 20
3	Culverts.....	15
4	Bridges.....	50 to 90

d. Road Maintenance. After rehabilitation, and not allowing for further damage in action, suitably trained and equipped engineer troops maintain roads on the basis of 15 man-hours net effective effort per mile of road per day.

e. Policy for Road and Bridge Construction.

(1) *Responsibility.* Between combat and communications zone, bridging is normally on an area basis. Communications zone forces take over all bridging operations in rear of the army area as rapidly as possible. All rearward elements assume bridge and road maintenance in forward areas as soon as the situation permits. Rearward engineer units are charged with replacing tactical and other portable types of bridging with nonportable types as quickly as possible, strengthening bridging to carry successively heavier loads, and removing such tactical bridging as the situation justifies.

(2) *General bridge policy.* Tactical bridg-

ing is normally placed by corps engineers. Organizational equipment will be replaced as quickly as possible by rearward engineers with heavier bridging. Stocks of Bailey, 30- and 60-foot I-beam, 90-foot pony truss bridging, and timber trestle bridge with steel beams are available in depots for use in the communications zone and also in the combat zone when time and the tactical situation permit. Bailey bridging will be utilized by forward units when practicable. Replaced and surplus bridging is returned to depots.

8.6. Railway Construction

a. New Construction.

- (1) The railroad division used in planning includes 100 route miles of main line, single or double track, together with its terminal operating and maintenance facilities, fueling and watering facilities as required, and the necessary signaling equipment or interlocking facilities for safe operation. Passing sidings on single-track lines, stations, and crossovers at double-track lines at stations are at intervals as required by the traffic. Normally, at least one spur or siding is provided at each station.
- (2) Materials and man-hours (net effective) required for new construction of 1 mile of standard gage (4 ft 8½ in.), single-track railroad.

¹ Based on pit-bank run gravel except lines 6 and 7, which are based on crushed rock for material.

² The tabulated man-hours do not include effort for bridging and culverts.

	1	2	3	4
	Item	Short tons	Measurement tons	Man-hours
2	Grading-----			¹ 5,000
3	Ballast delivered-----			² 2,500
4	Track laying and surfacing-----			³ 3,400
5	Bridging—70 linear feet per mile.	128	111	3,200
6	Culverts—7 per mile—280 linear feet.	8	7	1,400
7	Ties—2,900-----	218	300	-----
8	Rail—85 lb-----	150	42	-----
9	Fastening (based on 39 feet rail).	33	10	-----
10	Total-----	537	470	15,500

¹ Includes clearing based on average wooded terrain.

² Bank-run material, average haul—5 miles.

³ Allows 400 man-hours per mile for placing ties, delivered at site.

b. Rehabilitation. The following table reflects the rehabilitation requirements which can be anticipated for a 100-mile standard gage single-track division extending inland from a port, using average percentages of demolition over the entire division.

	1	2	3	4	5	6	7
	Items	Quantity per 100 miles	Demolition percentage	Rehabilitation (quantity)	Material ¹		Man-hours ¹ (thou)
					Short tons	Meas tons	
2	Main line-----	100 mi	13	13 mi	2,380	675	68
3	Port trackage ² -----	3 mi	100	3 mi	1,440	1,098	14
4	Passing sidings ² -----	4.5 mi	80	3.6 mi	1,730	1,320	17
5	Station sidings ² -----	3 mi	80	2.4 mi	1,150	880	12
6	Railway terminal ^{2 3} -----	1 ea	75	0.75 ea	7,100	6,800	160
7	Regulating station ^{2 4} -----	1 ea	-----	1 ea	6,530	7,340	230
8	Water stations-----	3 ea	100	3 ea	135	210	9
9	Fuel station-----	1 ea	100	1 ea	21	18	1
10	Bridging-----	7,000 lin ft	70	4,900 lin ft	8,950	7,770	224
11	Culverts-----	195,000 lin ft	15	29,400 lin ft	120	105	21
12	Grading-----	-----	-----	-----	-----	-----	35
13	Ballast-----	-----	-----	-----	-----	-----	44
14	Ties, main line-----	-----	6	6 mi	1,310	1,800	3
15	Total-----	-----	-----	-----	30,866	28,016	838

¹ Tunnels require special consideration. To repair (by timbering) a 50-foot demolition at each end of a single-track tunnel (100' total per tunnel), allow 70 short tons, 87 measurement tons, and 3,000 man-hours.

² Estimate includes ties, rails, fastenings, turnouts, and track laying and surfacing. It assumes ballast is available at work sites.

³ Includes replacement of buildings 100 percent, ties 30 percent, rail and turnouts 85 percent.

⁴ Provides minimum requirements for replacement buildings, rail and turnouts 100 percent, ties 85 percent, man-hours 100 percent of new construction.

8.7. Water Terminal Construction

a. Approximate Planning Factors. The following planning factors give the materials and man-hours required for water terminal facilities adequate for the handling of 720 short tons of discharged dry cargo per day of 20-hour operation. This is a convenient unit because it is the wharf discharge rate of one ship, Victory type, as given in paragraph 7.6*d*. The facilities

include ship or lighterage wharf space, access road from wharf to road net, and minimum covered and open storage. Of the four factors given, cases I and II are based on new wharf construction, the others on rehabilitation.

- (1) *Case I.* New construction of 500 linear feet of deep-draft marginal wharf (par. 7.6), and port facilities for 720 short tons per day.¹

¹If site conditions favor finger-type piers 500 feet by 90 feet, 2 berths per pier, the above factors *per berth* continue to apply.

	1	2	3	4
	Item	Short tons	Measurement tons	Man-hours
2	Timber pile marginal wharf, 500' x 60'.	1,200	2,000	15,000
3	0.7 mile of access road, asphalt-surfaced, 22' wide.	65	80	14,000
4	2 miles of railroad, including sidings ¹ .	675	500	14,500
5	10,000 square feet covered storage ² .	65	45	1,800
6	60,000 square feet open storage	-----	-----	50
7	Total-----	2,005	2,625	45,350

¹ Based on 75-pound rail and upon normal requirements for service and yard tracks and for terminal car storage.

² Based on shell-type insulated warehouses (par. 5.57m) with 3-inch concrete floors.

- (2) *Case II.* New construction of 350 linear feet of marginal lighterage wharf (par. 7.6) and port facilities for 720 short tons per day.

	1	2	3	4
	Item	Short tons	Measurement tons	Man-hours
2	Timber pile marginal wharf, 350' x 35'.	600	800	8,400
3	0.7 mile of access road, asphalt-surfaced, 22' wide.	65	80	14,000
4	2 miles of railroad, including sidings ¹ .	675	500	14,500
5	10,000 square feet covered storage ¹ .	65	45	1,800
6	60,000 square feet open storage	-----	-----	50
7	Total-----	1,405	1,425	38,750

¹ Notes 1 and 2, case I, apply also to case II.

- (3) *Case III.* Rehabilitation of 500 linear feet of deep-draft wharf, clearance of debris, and new construction of other terminal facilities for 720 short tons per day.

	1	2	3	4
	Item	Short tons	Measurement tons	Man-hours
2	Repair of 500 linear feet of deep-water wharf ¹ .	1,375	2,910	25,000
3	0.7 mile of access road, asphalt-surfaced, 22' wide.	65	80	14,000
4	2 miles of railroad, including sidings ² .	675	500	14,500
5	10,000 square feet covered storage ² .	65	45	1,800
6	60,000 square feet open storage	-----	-----	50
7	Clearing debris ³ -----	-----	-----	2,500
8	Total-----	2,180	2,815	57,850

¹ Based on repair of cratered wharf faces by timber and V-trestle construction to a width of 60 feet.

² Notes 1 and 2, case I, apply also to case III.

³ Based on 10 percent of the man-hours in line 2.

- (4) *Case IV.* Rehabilitation of 350 linear feet of lighterage wharf, clearance of debris, and new construction of other port facilities for 720 short tons per day.

	1	2	3	4
	Item	Short tons	Measurement tons	Man-hours
2	Repair of 350 linear feet of lighterage wharf ¹ .	580	920	10,500
3	0.7 mile of access road, asphalt-surfaced, 22' wide.	65	80	14,000
4	2 miles of railroad, including sidings ² .	675	500	14,500
5	10,000 square feet covered storage ² .	65	45	1,800
6	60,000 square feet open storage	-----	-----	50
7	Clearing debris ² -----	-----	-----	1,100
8	Total-----	1,385	1,545	41,950

¹ Based on repair of cratered wharf faces by timber or steel sheet pile.

² Notes 1 and 2, case I; and note 3, case III, apply also to case IV.

b. Construction Rate for Pile-and-Timber Wharves. Normally, 1 engineer construction company constructs 500 linear feet of deep-draft marginal wharf, or equivalent, in about 6 days. These rates cannot be improved by using a force larger than a company on one wharf structure of these sizes because of the sequences necessary in pile driving, capping, bracing, and deck construction.

c. Demolition of Existing Facilities. Experience in the invasion of developed harbors indicates the average percentages of demoli-

tions to be anticipated are as tabulated below. In addition, the removal of sunken wrecks or blockships may be required; normally, 2 or 3 in a small harbor, 10 or 20 in a large one. If the harbor entrance is narrow, it is usually found blocked.

	1	2
1	Facilities	Average demolition
2	Permanent wharves or quays.	30 percent very badly damaged; early repair impracticable. 30 percent heavily damaged; much debris; reasonably early repair possible. 40 percent lightly damaged; less debris; early repair practicable.
3	Port cranes-----	100 percent destroyed.
4	Port warehouses----	50 percent to 100 percent destroyed.

d. Utilities Required at Ship Wharves.

(1) *Fresh water.* With pressures normal in municipal water supply, one 4-inch pipeline with three 2½-inch outlets refills a Liberty ship's capacity of 115,000 gallons in 6 hours.

(2) *Illumination.* Five-hundred-watt incandescent lamps, mounted 35 feet above the wharf deck and spaced at intervals of 120 feet, provide adequate illumination averaging 1 to 2 foot-candles.

e. Construction Factors for Specific Types of Deep-Draft Wharves and Approaches. The following information is based on details in TM 5-280, using wood piles and timber deck.

	1	2	3	4
1	Type of wharf	Short tons	Measurement tons	Man-hours
2	Finger pier 500' x 90', 60' piles, no railway.	2,230	3,780	30,700
3	Finger pier 500' x 90', 60' piles, with railway.	2,255	3,960	33,150
4	Finger pier 500' x 90', 80' piles, no railway.	2,600	4,490	32,650
5	Finger pier 500' x 90', 80' piles, with railway.	2,755	4,725	35,225
6	Marginal wharf 500' x 60', 60' piles, no railway.	1,095	1,825	12,800
7	Marginal wharf 500' x 60', 60' piles, with railway.	1,160	1,915	14,080
8	Marginal wharf 500' x 60', 80' piles, no railway.	1,250	2,120	13,600
9	Marginal wharf 500' x 60', 80' piles, with railway.	1,315	2,210	14,960

	1	2	3	4
1	Type of wharf	Short tons	Measurement tons	Man-hours
10	Wharf approaches 30' wide (per 100 linear feet), no railway.	103	182	2,050
11	Wharf approaches 30' wide (per 100 linear feet), with railway.	120	195	2,180

f. Construction Factors for Specific Types of Marginal Lighterage Wharves Per 100 Linear Feet.

	1	2	3	4
1	Type of construction	Short tons	Measurement tons	Man-hours
2	Timber pile, 35 feet wide, using 40-foot piles.	171	228	2,400
3	Timber crib, supporting timber bents, 35 feet wide.	143	193	2,800
4	Timber retaining wall (Wakefield pile) with earth or rubble fill.	21	30.5	1,300
5	Steel sheet piling retaining wall with earth or rubble fill.	27	25	1,100

g. Construction Factors for Floating Pontoon Wharves. Reference—Pontoon Gear Handbook, 1 November 1952, Bureau of Yards and Docks, Department of the Navy. A floating wharf suitable for a Victory or Liberty ship berth is 6 pontoons wide by 72 pontoons long, or about 43 by 433 feet. Four approaches, each 4 by 18 pontoons, about 28 by 108 feet, are usually adequate. Total area of wharf and approaches is 30,715 square feet. The construction factors are—

	1	2	3	4
1	Floating pontoon wharves	Short tons	Measurement tons	Man-hours
2	Per 1,000 square feet-----	42	127	343
3	Wharf and approaches as above, 30,715 square feet.	1,290	3,900	10,535

h. Construction Requirements for Over-the-Beach Discharge of Cargo. Construction requirements for over-the-beach discharge of cargo include the construction of ramps, hardstands, egress roads, and beach stabilization. In general local materials will be used. The

length of the ramps varies, depending on beach gradient and tidal range. The length of the ramp can be computed by the following formula:

$$\text{Beach gradient (ft)} \times [\text{tide range (ft)} + 4] = \text{ramp length.}$$

The man-hours required for the construction of 100 feet of various types of ramps, hardstands, and beach stabilization are as follows:

1	2
Facility	Man-hours
Amphibious vehicle ramp (DUKW, DRAKE, BARC), 56' wide x 100' long x 1.5' deep.	930
Landing craft ramp (LSU/LCM/LST), 29' wide x 100' long x 1.5' deep.	480
DUKW ramp, 15' wide x 100' long x 1.5' deep.	252
Hardstands and beach stabilization, 100' x 100' x 0.5' deep.	555
Maintenance: Ramps: 10% of initial effort per month. Hardstands and beach stabilization: 10% of initial effort per quarter.	

Note. See paragraph 8.5 for road construction factors.

8.8. Dredging

Since dredging is a slow operation, dredging harbors in a military operation should be avoided if possible. Likewise, because of the danger of damaging foundations, plans should not anticipate dredging in the close proximity of quay walls. Generally, demolition debris can be cleared in front of berthing sites by the use of dragline or clamshell cranes. If dredging of harbor areas is unavoidable, the following overall planning factors may be used as a guide. Dredging quantities vary considerably with the type of equipment used, the distance of haul to the spoil area, the method of haul, and the kind of material being excavated (sand, mud, gravel, soft rock or coral, hardrock, etc.).

1	2	3	4	5
Type of dredge	Hydraulic suction ¹	Dipper	Clamshell or orange peel	Seagoing hopper ²
Size	12"-28" pipe	2-16 cubic yards	1-9 cubic yards	700-5,000 cubic yards.
Operating personnel	Varies from 12-90-man crews, depending on size of dredge and number of shifts being worked.			
Operating characteristics and principal use.	Soft digging, river channel dredging.	Clay, rock, or debris excavation.	Dredging in limited areas, caisson work, debris clearance.	Outer harbor work. Spoil area may be several miles away.
Maximum swells affecting operations.	3'	10'	10'	Designed for dredging in rough water.
Maximum dredging depth (feet).	15'-65'	20'-50'	10'-60'	36'-60'.
Average daily capacity ³ (cubic yards)	5,400 (12") 28,000 (28")	2,000 (2 cu yd) 9,000 (16 cu yd)	500 (1 cu yd) 3,000 (9 cu yd)	6,500 (700 cu yd). 10,000 (5,000 cu yd).

¹ The average distance which this type of dredge pumps to a spoil area is 1,000-3,000 feet. On the Fort Peck Dam, the 28" dredge pumped 11,000-31,000 feet.

² The 700-cubic yard "Hoffman Type" dredge was designed for use in World War II. It is especially useful in cutting a channel across a shoal at a harbor entrance. In a military operation, it is probable that all other dredging would be accomplished with local equipment or on-site expedients.

³ Dredges normally require 1 day per week shutdown for maintenance. These figures do not include maintenance delays but do include time consumed in moving the dredge along the cut area.

8.9. General Construction

a. General. This paragraph presents planning factors for engineer materials and man-hours required for construction of facilities in the following categories:

(1) Troop camps.

(2) Administration.

(3) Hospitals.

(4) Depots.

(5) Shops.

(6) Refrigeration and ice plants.

(7) Personnel service buildings, including

laundries, dry-cleaning plants, bakeries, recreation centers, and base post offices.

(8) Prisoner of war camps.

b. Troop Camps.

(1) *Standards.* Troop camp requirements are estimated in six standards intended for varying degrees of permanence.

(a) *Standard 1.* TOE tents; no engineer materials or effort involved.

(b) *Standard 2.* Class IV tents pitched by using troops; no engineer materials or effort involved.

(c) *Standard 3.* Buildings with floors for administration, bathhouses, infirmaries, storehouses, and kitchens. Class IV tents with floors for housing and with earth floors for all other purposes. Roads within the installations are stabilized with local materials. Water piped from central storage tank to infirmaries, bathhouses, and kitchens. Electric distribution to buildings. Pit-type latrines.

(d) *Standard 4.* Buildings with floors

for all purposes except housing, for which there are class IV tents with floors and wood frames. Roads within the installations are stabilized with local materials. Water piped from central storage tank to infirmaries, bathhouses, kitchens, and camp exchange. Electric distribution to all facilities. Pit-type latrines.

(e) *Standard 5.* Buildings with floors for all purposes; otherwise, the same as standard 4 above.

(f) *Standard 6.* Latrines equipped with untreated sewage carried 1,000 feet beyond the confines of the camp; bituminous surfacing of roads within the installations; otherwise, the same as standard 5 above.

(2) Structures will be prefabricated (metal-type) or standard (wood) frame for all climates. The following table states material and man-hour requirements, based on use of prefabricated buildings for the various standards of camps in the temperate climate, sizes from 250 to 3,000 men.

	1	2	3	4	5	6	7	8
1	Standard	Size (number of men)	Electric (KW)	Water (M gal/day)	Site areas (acres)	Materials		Man-hours
						Short tons	Meas tons	
2	1	Organic tents—no engineer materials or effort required.						
3	2	Class IV quartermaster tents erected by using service. No engineer materials or effort required.						
4	3	250	2.2	3.7	10	87	146	5,115
5		500	7.9	7.5	20	149	269	9,705
6		1,000	12.6	15.0	35	278	501	16,795
7		1,500	15.4	22.5	50	389	704	24,565
8		3,000	27.0	45.0	75	605	1,181	43,320
9	4	250	5.4	6.3	10	127	224	8,505
10		500	17.3	12.7	20	249	481	16,500
11		1,000	31.6	25.5	35	470	901	30,055
12		1,500	39.4	38.2	50	630	1,200	41,400
13		3,000	78.0	76.5	75	1,215	2,346	82,515
14	5	250	5.5	6.3	10	160	346	9,185
15		500	17.3	12.7	20	320	713	17,075
16		1,000	31.3	25.5	35	606	1,347	31,350
17		1,500	39.1	38.2	50	840	1,882	42,075
18		3,000	77.5	76.5	75	1,691	4,125	86,305
19	6	250	5.5	10.6	10	168	356	9,525
20		500	17.4	21.2	20	358	758	18,205
21		1,000	31.4	42.5	35	676	1,430	31,620
22		1,500	39.0	63.7	50	947	1,981	43,915
23		3,000	78.4	127.5	75	1,934	4,402	90,145

c. Administration Facilities.

(1) *Standards.* Estimates are based on three standards: standard 3, standard 4, and standard 6. Standards specifications are the same as for troop camps.

(2) *Structures.* Structures will be primarily prefabricated. Material and man-hour requirements for administrative offices in temperate climate for 10,000, 25,000, and 50,000 square feet are listed in the following table.

	1	2	3	4	5	6	7
1	Standard	Size office space (M sq ft)	Electric (KW)	Water (GPD)	Materials		Man-hours
					Short tons	Meas tons	
2	3	10	11.3	250	83	197	4,195
3		25	27.4	625	193	478	9,405
4		50	52.2	1,250	371	935	17,355
5	4	10	11.3	250	102	238	4,890
6		25	27.4	625	210	515	10,010
7		50	52.2	1,250	401	998	18,355
8	6	10	11.3	2,125	115	259	6,170
9		25	27.4	5,300	242	558	12,210
10		50	52.2	10,625	454	1,069	21,905

d. *Hospitals.*

(1) *Standards.* Estimates are based on three standards similar in permanence to troop housing of standards 2, 4, and 6, respectively, as follows:

(a) *Standard 2.* All facilities in organic and class IV tents, hospital tents floored and framed, personnel tents pitched by using troops with no engineer materials or assistance. Water piped from central storage tank to necessary facilities; roads unimproved; pit latrines.

(b) *Standard 4.* Buildings for all facilities except hospital wards and personnel housing, for which con-

crete tent floors and wood frames are provided. Estimates do not provide for ice plants, laundries, or refrigerated warehouses. Estimates include stabilized roads, water and electric distribution, plumbing, and waterborne sewage, but do not include sewage disposal plants.

(c) *Standard 6.* Buildings and utilities complete for all facilities as described in TM 5-280. Bituminous surfaced roads are included.

(2) *Material and man-hour requirements* for 25- to 1,000-bed hospitals of the above standards are as shown in the following table.

1	1	2	3	4	5	6	7	8
	Standard	Size (Beds)	Electric (KW)	Water (M gal/day)	Site areas (acres)	Materials		Man-hours
						Short tons	Meas tons	
2	2	25	20	1.2	5	25	30	2,700
3		50	30	2.5	5	30	35	3,300
4		100	40	5.0	10	45	55	4,700
5		200	60	10.0	15	70	85	5,800
6		300	90	15.0	20	110	130	7,000
7		500	130	25.0	30	170	200	10,300
8		750	200	37.5	40	250	280	12,500
9		1,000	250	50.0	50	320	360	15,000
10	4	25	69	2.1	5	317	676	23,870
11		50	77	4.3	5	349	749	25,910
12		100	135	8.5	10	591	1,196	45,900
13		200	195	17.0	15	808	1,763	60,700
14		300	286	25.5	20	1,128	2,433	79,835
15		500	411	42.5	30	1,552	3,414	108,355
16		750	540	63.7	40	2,057	4,642	138,520
17		1,000	660	85.0	50	2,426	5,460	165,840
18	6	25	67	2.1	5	400	839	28,270
19		50	77	4.3	5	432	913	30,300
20		100	144	8.5	10	817	1,650	54,465
21		200	208	17.0	15	1,125	2,371	70,980
22		300	302	25.5	20	1,572	3,310	96,720
23		500	435	42.5	30	2,166	4,679	131,995
24		750	575	63.7	40	2,794	6,165	168,595
25		1,000	698	85.0	50	3,296	7,196	198,395

e. *Depots.*

(1) *Standards.* Estimates are based on 3 standards of construction for covered and open dry cargo storage and 2 standards for ammunition storage as follows:

(a) *Dry cargo storage.*

1. *Standard 2.* Class IV tents for all facilities requiring cover. Open storage cleared, graded, and drained. Roads graded, but not surfaced.

2. *Standard 3.* Sheds for covered storage; class IV tents with floors

for administrative space; without floors for other facilities requiring cover. Roads stabilized. Railroad sidings to open storage areas. Drainage and fencing provided when required.

3. *Standard 5.* Closed buildings for covered storage and administrative facilities. Bituminous surfaced main access roads to covered and open storage areas; other interior roads stabilized. Railroad sidings to storage areas. Drainage and fencing providing when required.

(b) *Ammunition storage.*

1. *Standard 2.* Class IV tents for 10 percent of the ammunition tonnage and for administrative facilities. Open storage areas cleared and graded. Access roads graded but not surfaced.
2. *Standard 3.* Sheds for 10 percent of the ammunition tonnage. Buildings for administrative facilities. Access roads and parts of open storage areas stabilized with local materials. Railroad sidings to storage areas.

(2) *Material and man-hour requirements* for storage construction of the above standards are as follows:

(a) *Dry cargo storage—covered.*

1	2	3	4	5		6	7
	Standard	Size (M sq ft)	Electric (KW)	Site area (acres)	Materials		Man- hours
					Short tons	Meas tons	
2		25	-----	2	0.5	0.5	500
3	2	50	-----	4	1	1	1,000
4		100	-----	8	2	2	2,000
5		25	8	2	52	55	3,000
6	3	50	17	4	130	130	10,000
7		100	30	8	220	230	14,000
8		25	10	2	200	185	7,000
9	5	50	17	4	470	450	19,000
10		100	30	8	1,016	930	35,000

(b) *Dry cargo storage—open.*

	1	2	3	4	5	6
1	Standard	Size (M sq ft)	Site area (acres)	Materials		Man- hours
				Short tons	Meas tons	
	2		100	5	1	1
3	2	200	10	2	2	4,000
4		400	20	3	3	7,000
5		100	5	230	260	9,000
6	3	200	10	450	480	16,000
7		400	20	800	820	28,000
8		100	5	285	275	12,000
9	5	200	10	500	520	20,000
10		400	20	920	950	35,000

(c) *Ammunition storage — 10 percent covered; 90 percent open.*

	1	2	3	4	5	6
1	Standard	Depot capacity (tons)	Site area (acres)	Materials		Man- hours
				Short tons	Meas tons	
2	2	1,000	140	3	4	7,600
3		5,000	690	12	16	30,400
4		25,000	3,450	45	60	114,000
5	3	1,000	140	18	14	8,200
6		5,000	690	112	101	33,500
7		25,000	3,450	445	420	127,600

f. *Shops.*

(1) *Covered shop requirements* in square feet of floor area for various service units.

1	2	3
	Service	Unit
2	Chemical-----	Depot company (CommZ) 1,000 Decontamination company. 800 Laboratory----- 5,200 Processing company----- 11,900 Maintenance company----- 4,600
3	Engineer-----	Gas generator team----- 2,000 Foundry team----- 2,500 Field maintenance company. 9,000
4	Ordnance-----	Direct automotive support company. 25,000 Heavy automotive maintenance company. 40,000

	1	2	3
1	Service	Unit	Square feet
		Armament rebuild bat- talion.	100,000
		Automotive rebuild bat- talion.	100,000
		Heavy maintenance com- pany, field army.	30,000
		Direct support company	20,000
		Tire rebuild company	16,000
		Guided missile direct sup- port shop.	12,000
		Guided missile heavy sup- port shop.	12,000
		Guided missile depot sup- port shop.	12,000
		Motor vehicle assembly company.	20,000
5	Signal	Base maintenance com- pany.	50,000
6	Transportation	Light truck company	3,700
		Medium truck company	5,600
		Heavy truck company	5,100
		Equipment company, trans ry op bn.	20,000
		Railway operating bat- talion.	8,000
		Railway shop battalion	40,000
		Aircraft intermediate sup- port company.	40,000
		Transport aircraft main- tenance company.	40,000
		Transport helicopter maintenance company.	40,000
		General support aircraft maintenance company.	80,000
		General support helicop- ter maintenance com- pany.	80,000
		Depot support battalion	200,000

(2) *Material and man-hour requirements for various standard 5 shops are as follows:*

(a) *Shops, general.*

1	2	3	4	5	6	7
Capacity (sq ft)	Site area (acres)	Electric (KW)	Water (GPD)	Materials		Man- hours
				Short tons	Meas tons	
5,000	1.8	18	50	80	90	3,100
50,000	5	175	500	1,090	1,090	27,700

(b) *Shops, special.*

	1	2	3	4
1	Type	Materials		Man- hours
		Short tons	Meas tons	
	Ordnance:			
2	Collecting point	2,450	2,500	98,200
3	Base park	1,700	1,750	75,900
4	Armament rebuild	3,000	3,300	139,400
5	Automotive rebuild	2,650	2,850	127,200
	Transportation:			
6	Marine railroad repair shops, 500-ton.	534	737	28,500
7	Marine railroad repair shop, 1,800-ton.	1,428	2,028	49,400

g. Ice Plants and Refrigerated Storage. Ma-
terial and man-hour requirements for ice plants
and refrigerated storage.

	1	2	3	4	5	6	7
1	Facility	Size	Water (GPD)	Electric (KW)	Materials		Man-hours
					Short tons	Meas tons	
2	Ice plant	1 ton	250	0.1	18	30	870
3	Ice plant	3.6 ton	1,000	10	23	43	1,120
4	Ice plant	15 ton	4,000	46.3	131	243	2,950
5	Refrigerated warehouse	20' x 55'	100	15.6	41	92	1,600
6	Refrigerated warehouse	20' x 100'	100	23.4	76	175	2,400
7	Refrigerated warehouse	80' x 220'	100	141	552	1,312	13,640

h. Personnel Service Facilities. Material and man-hour requirements for buildings are as follows:

	1	2	3	4	5	6	7
	Description	Size	Water (M GPD)	Electric (KW)	Materials		Man-hours
					Short tons	Meas tons	
2	Dry-cleaning plant, w/boilerhouse	1,000-man	4.4	5.7	12	29	1,280
3	Dry-cleaning plant, w/boilerhouse	2,500-man	5.4	8.5	15	39	1,440
4	Dry-cleaning plant, w/boilerhouse	5,000-man	8.4	23.6	31	64	2,160
5	Laundry, w/boilerhouse	2,500-man	67.5	35.4	102	220	5,830
6	Laundry, w/boilerhouse	5,000-man	141.0	69	141	312	8,020
7	Laundry, w/boilerhouse	10,000-man	249.0	117.4	236	517	11,690
8	Bakery ¹	Mobile			96	79	1,970
	Base post office:						
9	Type O, Std 3	11,200 sq ft		8.2	89	237	3,860
10	Type U, Std 3	80,000 sq ft	0.5	49.4	458	1,589	21,765
	Recreation center:						
11	Standard 2	5,000-man	10.0	21.4	55	82	4,940
12	Standard 3	5,000-man	10.0	21.4	81	108	5,380
13	Standard 4	5,000-man	10.0	28.3	234	695	10,955
14	Standard 5	5,000-man	10.0	40.3	314	761	14,455
15	Standard 4	10,000-man	20.0	52.5	464	1,099	19,050
16	Standard 5	10,000-man	20.0	79.5	722	1,513	28,035

¹ Quartermaster mobile bakery requires building space to house its equipment when operating for an extended period of time in one location. These are shell buildings only.

i. Prisoner of War Camps.

(1) *Standards.* Estimates are based on three standards of permanence (2, 3, and 5) similar to troop housing and described as follows:

(a) *Standard 2.* Class IV tents with earth floors for prisoner of war housing. Bucket-type latrines. Engineer construction consists of security fences, lighting, guard towers, and water piping to the central inclosure.

(b) *Standard 3.* Bathhouse, latrine, and

kitchen in buildings; all other accommodations in tentage. Two-inch concrete floors in buildings and tentage. Electric distribution to buildings. Security fences, lighting, guard towers, and water supply same as standard 2. Bucket-type latrines.

(c) *Standard 5.* All accommodations in buildings. Four-inch concrete floors in storehouse, in all other buildings two-inch. Other construction same as standard 3.

(2) *Material and man-hour requirements.*

	1	2	3	4	5	6	7	8
	Standard	Size (number of PW)	Electric (KW)	Water (M gal/day)	Site area (acres)	Materials		Man-hours
						Short tons	Meas tons	
1		500	-----	2.5	19	131	168	10,000
2		1,000	-----	5.0	30	193	255	15,000
3		4,000	-----	20.0	66	555	786	52,000
4								
5		500	23	5.0	19	242	344	17,000
6		1,000	31	10.0	30	394	574	25,000
7		4,000	123	40.0	66	1,398	2,165	90,000
8		500	26	8.5	19	368	712	23,000
9		1,000	39	17.0	30	613	1,224	35,000
10		4,000	155	58.0	66	2,189	4,619	127,000

j. Bivouacs, Camps, and Billets.

- (1) *Bivouac areas.* The bivouac area of an infantry battle group size unit will vary from 50 acres to 1 square mile, as indicated by the situation. Considerations which affect the area required are the dispersion necessary to minimize the threat of enemy attack, the amount of cover and concealment available, and the characteristics of the terrain. The approximate minimum area required by a unit may be estimated as indicated below.

Note. Both methods should be used and the larger figure chosen.

- (a) *Vehicle dispersion.* When required dispersion of the vehicles with the unit should govern, use the following formula:

$$\frac{V \times D^2}{K} = \text{area required, when}$$

V = Number of vehicles with the unit.

D = Desired dispersion between vehicles.

K = Conversion factor, as appropriate, to reduce the area to acres, hectares, square miles, or square kilometers.

Example: Assume that an infantry battle group has 650 vehicles, and a dispersion of 100 yards between vehicles is desired. Find the acres required.

$$\frac{650 \times (100)^2}{4,840 \text{ (sq yd per acre)}} = 134.3 \text{ acres.}$$

Personnel will be distributed throughout the area.

- (b) *Tent camps—capacity.* Large pyramidal tent, normal assignment—6 to 8 men per tent; area required for an infantry battle group camp (open ground) approximately—50 acres; estimate of area required—50 square yards per man; 100 square yards per vehicle.

(2) *Data on tentage.*

	1		2	3	4	5	6
1	Data on tentage		Surface area (square ft)	Floor space (square ft)	Vertical wall (height)	Weight in pounds per unit (packed)	Cubage per unit (packed)
	Type	Dimensions					
2	Assembly-----	40 ft x 80 ft-----	4,965	2,860	8 ft 0 in.	1,000	34.35
3	Command post-----	11 ft 10 in. x 7 ft 6 in.---	328	90	6 ft 2 in.	114	6.8
4	Hospital ward-----	50 ft x 16 ft-----	2,162	800	4 ft 6 in.	395	19.8
5	Pyramidal-----	16 ft x 16 ft-----	896	256	3 ft 0 in.	133	6.0
6	Storage-----	17 ft 10 in. x 20 ft 5 in.---	1,008	364	5 ft 2 in.	210	6.5
7	Wall, large-----	14 ft 6 in. x 14 ft 4 in.---	570	210	4 ft 6 in.	152	6.1
8	Wall, small-----	18 ft 10 in. x 9 ft 2 in.---	492	168	3 ft 9 in.	57	2.7
9	Paulin, large-----	20 ft x 40 ft-----	800	-----	-----	160	4.2
10	Paulin, small-----	12 ft x 17 ft-----	204	-----	-----	57	2.3
11	Screen, latrine-----	8 ft x 52 ft-----	416	-----	-----	45	1.1
12	Squad ¹ -----	16 ft x 32 ft 7.5 in.---	886	522	4 ft 9 in.	474	18.5
13	Gen purp, med-----	16 ft x 32 ft 8 in.---	-----	523	5 ft 6 in.	-----	-----
14	Maint shelter-----	18 ft x 26 ft-----	-----	485	4 ft 8 in.	-----	-----

¹ Limited standard; will be replaced by medium tent, general purpose, as stocks are depleted.

(3) *Space allowances for quarters under theater of operations conditions:*

(a) *Normal*—40 square feet floor space and 40 cubic feet air space per person.

(b) *Emergency*—50 percent of the above.

(4) *Billets.* In hostile or liberated territory, the capacity of a locality for billeting is approximately as follows:

Rich farming country

Cities

Average American city

Vacant buildings and dwellings in average city (civilians may be caused to move to vacancies in order to concentrate military activities).

With civilians furnishing subsistence---

5 percent inhabitant.

2 percent inhabitant.

20 per vacant dwelling.

10 percent of population.

10 percent of population for 1 week.

k. Housing Requirements in Addition to Troop Camps. In addition to those troop housing facilities provided for normal functions of troops, it is usually necessary to provide additional installations based upon the following percentages of the theater population.

	1	2
1	Facility	Percentage of theater troops
2	Recreation center.....	5% of total.
3	Reception center.....	5% of total.
4	Replacement depot.....	3% of total.
5	Casual camp.....	1% of total.
6	Ground troop training center..	5% of all ground forces.
7	Service force training center..	5% of all service troops.
8	Labor camp.....	5% of prewar population in area.
9	Temporary refuge for displaced persons.	5% of prewar population in area.
10	Military prisoners.....	1% of total.
11	Undesirable civilians (saboteurs, etc.).	5% of prewar population in area.

l. Office Space. Space allowances for offices under theater of operations conditions: 60 square feet per person employed plus 10 square feet per drafting board.

m. Shell, Prefabricated, and Standard Frame Buildings.

- (1) The shell building TO 211.71 (with dimensions of 20 feet x 54 feet) consists of precut wooden framing, with the roof and part of the sides covered with corrugated steel sheets. All the material for the 20 feet x 54 feet building is shipped in a single package. The length may be changed by the addition or omission of 9 feet intermediate bays. The width may be increased to 46 feet by modifying the

heights of the posts and the roof system. Partial insulation can be obtained by closing the sides and using a special kit and complete insulation with additional sidewall materials. A 2-inch concrete floor is laid if required. This type is suitable for temperate and tropical climates.

- (2) The shell building TO 211.75 (with dimensions of 110 feet by 405 feet) consists of precut wooden framing with a corrugated steel roof and open sides. It is shipped in 31 packages. If required, the sides are closed and a concrete floor laid. This building is used primarily for depot storage.
- (3) Barrack, portable, prefabricated steel angle frame, TO 211.59 and TO 111.61, (with dimensions of 20 feet x 48 feet) is the basic unit for prefabricated construction. This building can be modified and expanded by the addition of 20 feet x 8 feet units. These units are designated as window unit "B" and door unit "C," respectively. These buildings are normally used only in hospital construction; TO 111.61 in temperate climates, and TO 211.59 in tropic climates.
- (4) Standard frame buildings are constructed in various dimensions and designs from standard materials listed in TM 5-280. Because of the large lumber and man-hours requirements involved, this construction is normally restricted to special-purpose buildings, such as refrigerated warehouses, ice plants, laundries, dry-cleaning plants, special shops, and facilities for frigid climates.

8.10. Bulk Petroleum Storage and Distribution

a. General. See paragraphs 5.13 through 5.23 for petroleum; paragraph 5.14 for types and capacity of carriers in general use; and paragraph 7.16 for sizes and capacities of pipelines. See TM 5-350 for descriptions and operating characteristics of pipeline equipment and AR 701-9100-1 for technical service responsibilities. A complete pipeline system includes tanker discharge facilities and receiving

tank farm at a port or beach (marine terminal); 1 or more parallel pipelines; tank farms are generally spaced from 50 to 75 miles apart along the system and vary in size from 50,000 barrels capacity to 1,000,000 barrels capacity, depending upon logistical supply needs and specified theater levels of supply; dispensing facilities are provided at tank farms and army supply points. Engineer troop units construct petroleum distribution systems.

b. Pipelines. Four-, six-, and eight-inch diameter, lightweight pipe is standard for military pipeline systems. On level terrain, pump stations are spaced 8 miles apart for 4-inch lines and 17 miles apart for 6-inch and 8-inch lines. Submarine ship-to-shore lines are 12-inch heavy welded lines running from the offshore tanker mooring to the receiving tank farm. They are provided by the Corps of Engineers as part of the equipment in marine terminal installations (*c* below) and are designed to unload T2 tankers in 24 hours.

100 miles pipeline	Short tons	Meas tons	Construction	
			Man-hours	Rate/engineer pipeline co*
4-inch w/pump stations.	2,360	3,340	59,600	6 miles/day
6-inch w/pump stations.	3,230	6,330	62,500	4 miles/day
8-inch w/pump stations.	4,770	9,100	91,500	3 miles/day

* Assisted by civilian or prisoner of war labor.

c. Tank Farms.

- (1) To determine the amount of tank farm construction required in a theater of military operations, the planner should first determine the required theater level of supply. This may vary from a 30-day level to a 60-day level, depending upon the distance of tanker haul and probability of tanker losses through enemy action. Using the planning factor stated in paragraph 7.17, the amount of construction required may be estimated by the following formula:

Number of division (plus air support) × 6,000 barrels per day × number days level of supply—available existing storage in theater = total storage construction requirement.

- (2) The following table provides data for

estimating tank farms construction along a pipeline system. The data include tanks, pipe manifolds to the individual tanks, pumps, valves, etc., necessary for operation of the tank farms. Current doctrine for dispersion of facilities prescribes that not over 250,000 barrels of bulk storage capacity will be constructed within 4 miles of another tank farm. Tank farm complexes listed below are group-

ings of 20,000-barrel or 250,000-barrel capacity installations, with sufficient intermediate pipeline and accessories to meet the dispersion criteria. Marine terminals listed below are used at ports or beaches and include the receiving tank farm and all facilities for offshore mooring of tankers and pumping petroleum products to the tank farm.

Installation	Capacity (thou bbls)	Site area (thou yd sq)	Short tons	Meas tons	Construction man-hours
Marine terminal.....	200	130	1,515	1,360	48,500
Marine terminal.....	400	220	3,700	3,340	112,300
Marine terminal.....	1,000	520	7,670	7,400	242,700
Tank farm.....	50	50	390	230	14,100
Tank farm.....	100	87	595	295	21,100
Tank farm.....	150	89	710	345	27,600
Tank farm.....	200	90	760	360	34,400
Tank farm.....	250	120	995	410	41,500
Tank farm complex.....	400	180	2,180	1,712	78,500
Tank farm complex.....	600	270	3,495	3,055	122,500
Tank farm complex.....	800	360	4,760	4,335	164,800
Tank farm complex.....	1,000	480	5,355	4,540	193,400

d. *Pipeline Communications.* A petroleum distribution system requires continuous communication between tank farm dispatches, pump station operators, and pipeline patrol units. The Signal Corps provides both radio-voice and teletype writer equipment for this communication system. Teletypewriter is used primarily for hourly recording of the flow of products along the pipeline and the transmission of dispatching instructions between tank farms (see par. 4.25).

e. *Pipeline Operations.* Pipelines should be used to the maximum extent possible, with the use of 5-gallon cans and 55-gallon drums limited to small volume products. Pipelines should follow combat operations sufficiently close to provide for the bulk refueling of combat vehicles, using tank trucks which are loaded at the pipehead. Pipelines must be intersectional and interzonal and controlled by one agency from beginning to end. Operation of military pipeline systems and organizational maintenance are the responsibilities of the Quartermaster Corps. The pipeline platoon of the

quarter master petroleum depot company (TOE 10-377) is capable of operating 120 miles of pipeline or 8 pumping stations. Additional quartermaster petroleum depot companies will be used when required for longer pipelines.

8.11. Nuclear Power Plants

a. *General.* Nuclear power plants can be designed to operate over extended periods without refueling, thereby reducing the logistical support effort.

b. *Capacities.* The Army package power reactor, utilizing a pressurized water reactor system, will produce 2,000 kilowatts of electricity and will operate for a period of 18-24 months on one fuel loading weighing approximately 600 pounds (fuel oil equivalent, 54,400 barrels). Nuclear plants of this type can be designed with capacities in the range of 1,000- to 4,000-kilowatt electrical output. The heat output of the reactor can be split between electricity and steam for space heating in any ratio within the overall capability of the reactor. The ap-

proximate range of available net capacities is as follows:

Source	Maximum electrical Minimum heating	Minimum electrical Maximum heating
Electrical power-----	4,000 KW	
Steam for heating-----		20,000 KW

c. Construction. Because of the complex nature of nuclear power plants, highly skilled technicians are required for all construction except site preparation and building erection. The time for design and erection will average about 36 months under normal contracting procedures for military construction.

8.12. Airfield Construction

a. Construction Effort Required for Airfields in a Theater of Operations. This paragraph is useful for broad planning purposes only. For oversea theaters, it provides estimates for com-

puting engineer troop support required to construct U.S. Air Force installations. None of the factors in this section is suitable for the detailed planning required for construction of specific installations. Reference should be made to AFM 400-5, AFM 86-3, and TM 5-250 for more detailed planning data.

- (1) The table below gives the number of engineer battalion months required to accomplish emergency, minimum, and full operational construction of different type bases. A factor of 75 percent of total construction of a new base can be used to estimate the average construction required to reconstruct an existing base which makes use of a site where an airfield of some type does exist or has existed. These are average factors. They are not applicable to extreme climatic conditions and mountainous or swampy terrain.

Type base	Critical aircraft*	New base		
		Emergency operational	Minimum operational	Full operational
Heavy bomber:				
One wing-----	B-52 A, B, D	12.0	18.0	30.0
One squadron-----		10.0	15.0	18.0
Medium bomber:				
One wing-----	B-47, B, E	11.0	16.0	27.0
One squadron-----		10.0	14.0	22.0
Tactical bomber:				
One wing-----	B-57 B, C or	9.0	11.0	15.0
One squadron-----	B-66 B	8.0	10.0	13.0
Fighter bomber or fighter interceptor:				
One wing-----	A, B	6.0	9.0	13.0
One squadron-----		5.0	8.0	11.0
Troop carrier, heavy:				
One wing-----	C-97	9.0	11.0	15.0
One squadron-----		8.0	10.0	13.0
Troop carrier, medium:				
One wing-----	C-119	2.5	6.0	12.5
One squadron-----		2.0	4.0	6.5
Troop carrier, assault:				
One squadron-----	C-123	1.5	2.5	5.0
Air depot:				
One wing on base operating own base-----		11.0	19.5	37.5
One wing on base as tenant organization-----		4.0	12.5	29.0

* Aircraft requiring longest runway in each category.

- (2) The number of engineer heavy construction battalion months required to construct the different type bases is calculated from the man- and equipment-hour workload needed to build

each base. This is determined by specifying for each type base the kinds and numbers of facilities required for the performance of the function of the units supported by the base; i.e., AACs

station, housing, runway, etc. Each of these facilities is then broken down into the kinds and number of elements composing it; i.e., paved surfaces, shops, mess halls, and latrines. A man- and equipment-hour factor, such as 1.45 hours per square yard of paved surface, is then applied to each of these elements to compute the total man-hours required to construct each element. The number of hours for all elements is then added together to give the total man- and equipment-hours required to construct the base. This total is then converted to heavy construction battalion months by the factor; 140,000-man- and equipment-hours of construction is equivalent to 1 engineer heavy construction battalion month.

b. Conversion of Battalion Months of Efforts to Engineer Battalion. In order to compute manning, training, and equipping requirements, it is necessary to convert engineer battalion months as given above to heavy construction battalions. Thus, a construction task requiring 8 engineer heavy construction battalion months

can be accomplished by 1 engineer heavy construction battalion working for 8 months, 2 battalions for 4 months, or 4 battalions for 2 months, etc. In emergencies, immediate and urgent requirements may develop for the construction of complex installations such as a heavy bomber base. Theoretically, this could be done by concentrating enough battalions in the area to perform the required number of months of construction. However, the effect of over-saturation comes into play, and the efficiency of the work diminishes as the personnel, equipment, and supplies of the different battalions create interference. On the basis of these saturation considerations, the following table presents estimates of the number of battalions which can be employed most efficiently.

<i>Battalion months of construction effort required</i>	<i>Number of battalions best utilized</i>
25-35	4
15-24	3
5-14	2
Less than 4	1

8.13. Signal Construction Factors

a. Estimated Time Required for Line Work Operations.¹

Operation	Man-hours placing	Removing
Laying out and staking line open wire:		
150-foot span—mile.....	15	
Material distribution:		
Lightweight metal poles—each.....	0.4	
Round wooden poles—each.....	.5	
Wire and accessory materials 150-foot span—4 pairs—mile.....	6.0	
Insulated wire and accessory materials—150-foot span—mile.....	2.0	
Lead cable and accessory materials—per reel.....	1.8	
Holes—pole:		
Dug by hand—per hole.....	3.0	
Dug by machine—per hole.....	.5	
Dug by blasting, hand drilling—per hole.....	5.0	
Holes—anchor:		
Dug by hand—4 x 4 log—each.....	3.0	
Dug by machine—log or plank—each.....	.7	
Dug by machine—patent—each.....	.8	
Dug by hand— $\frac{5}{8}$ -inch rock—each.....	3.0	
Assembling hardware and placing crossarm—open wire:		
Lightweight metal—4 pins—each.....	.3	0.2
Round wood pole—8 pins—each.....	.5	.2
Setting poles (erecting, backfilling, and tamping):		
Lightweight metal—each.....	.4	.3
20-foot round—each.....	2.0	1.0
30-foot round—each.....	2.5	1.2

See footnotes at end of table.

Operation	Man-hours placing	Removing
Guying:		
Placing anchor and backfilling:		
Lightweight metal poles—each	.6	
Round pole log or plank—each	3.0	
Patent—each	2.0	
Placing and tensioning guying:		
W-145, 109 GS or similar—each	1.0	.6
Wire messenger, 2.2M—each	1.5	.8
Wire messenger, 6M or 10M—each	2.5	1.0
Installing line wire (placing, sagging, and tying in):		
1 pair—mile	25	13
4 pair—mile	40	18
Installing messenger wire:		
6 and 10M messenger—mile	36	30
16M messenger—mile	50	40
Placing lead covered cable on messenger:		
11 to 101 pair—mile	125	80
Above 101 pair—mile	164	116
Placing insulated wire on existing pole line—mile	12	7
Ground surface construction:		
Spiral 4—mile ²	2.6	2.6
Wire W-143 or similar—mile ²	2.2	2.0
Buried construction (using cable plow LC-61) ³ :		
Spiral 4:		
1 cable—mile	8.5	3
2 cables, same trench—mile	12.0	5
Jute covered, tape armored—mile	45	65
Constructing overhead crossing for insulated wire—each (installing messenger and rings, pulling in wire)—	5.2	

¹ Time indicated is maximum for any operation.

² For surveying, staking line, testing sections, and policing, add 12 man-hours per mile for spiral 4 and 6 man-hours per mile for wire W-143.

³ Does not cover operations in jungle, arctic, or desert areas.

b. Characteristics of Round Telephone Poles. (American Standard.)

Class		1	2	3	4	5	6	7
Minimum top circumference (inches)-----		27	25	23	21	19	17	15
Transverse breaking loads (pounds)-----		4,500	3,700	3,000	2,400	1,900	1,500	1,200
Type	Length	Approximate average weight (pounds)						
Western cedar, northern cedar, creosoted pine.	20-feet	700	600	500	400	300	225	200
		720	600	540	350	300	230	190
		635	555	479	418	353	310	259
	25-feet	850	720	600	480	400	320	250
		1,020	780	600	515	420	300	250
		898	808	686	602	508	423	362
	30-feet	1,000	850	730	610	500	420	350
		1,320	1,170	870	630	520	420	350
		1,241	1,076	921	780	672	573	489
	35-feet	1,200	1,000	850	750	650	560	470
		1,620	1,380	1,060	820	720	510	450
		1,603	1,410	1,213	996	865	733	616

Northern and western cedars are furnished butt treated; pine is treated full length. An estimate of the shipping space required for poles:

$$\frac{\text{Average weight (pounds)} \times \text{constant}}{40} = \text{measurement tons}$$

Values of the constant are:

Cedars = 0.052

Pine = 0.026

c. Comparison of the Means to Obtain Telephone Channels—100 Miles.

Channel	Construction time in man-days ¹	Short tons	Measurement tons
Radio relay, 4-channel ² ---	³ 65	10	26
Radio relay, 12-channel ² ---	³ 85	53	279
Radio relay, 24-channel ² ---	³ 125	53	279
CF carrier on spiral—4 (buried):			
Total 4 channels-----	285	50	75
CF carrier on spiral—4 (suspended):			
Total 4 channels-----	440	50	75
O carrier on open wire (lightweight metal poles and crossarms) 2 systems:			
Total 16 channels ⁴ ---	105	187	192
C carrier on standard open wire (30-foot poles spaced 150 feet)—4 systems:			
Total 16 channels ⁴ ---	⁵ 10,060	6,204	9,846
O carrier on standard open wire (30-foot poles spaced 150 feet):			
Total 32 channels ⁴ ---	⁵ 10,120	6,204	9,846

¹ Does not apply to operations in jungle, arctic, or desert.

² Repeater spacing, approximately 25 miles.

³ Includes only actual time to install equipment (including antennas and system lineup).

⁴ Repeater spacing, approximately 100 miles.

⁵ Construction time is based on signal construction battalion day consisting of 500 man-days and completion of 5 miles of O. W. per day.

d. Commercial Type Telephone Switchboard Capacity—Position Comparison.

Local switchboard capacity—lines	Positions
100-----	1 or 2.
400-----	7 basic.
600-----	10 basic.
800-----	11 basic.
1,000-----	14 basic.
1,200-----	16 basic.
1,600-----	22 basic.
2,000-----	27 basic.
2,800-----	40 basic.
3,600-----	60 basic.

Toll switchboard capacity—lines

100-----	15.
200-----	25.
300-----	34.
400-----	40.

e. LOCAL (Common Battery Manual)

Call Handling Time and Traffic Distribution.

(1) *Call handling time.*

One operator handles 150 calls per operator hour.

Two operators handle 200 calls per operator hour.

Three operators handle 220 calls per operator hour.

Four operators handle 225 calls per operator hour.

Five or more operators handle 230 calls per operator hour.

(2) *Distribution of traffic. (Average situation.)*

	Percent
Local calls -----	40
Outgoing trunk calls -----	30
Incoming trunk calls -----	30

100

f. TOLL (Common Battery Manual) Call Handling Time and Traffic Distribution.

(1) *Call handling time.*

One operator handles 20 calls per operator hour.

Two operators handle 25 calls per operator hour.

Three operators handle 30 calls per operator hour.

Four operators handle 35 calls per operator hour.

Five operators handle 40 calls per operator hour.

(2) *Distribution of traffic. (Average situation.)*

	Percent
Outward -----	55
Inward -----	30
Through (switchboard) -----	15

100

g. Normal Telephone Instrument Requirements.

(1) One per general officer.

(2) One per 2 field grade officers.

- (3) One per 4 company grade officers.
- (4) One per 50 or 100 enlisted men, depending on whether troop basis is on TOE basis or personnel are operating as part of a large headquarters staff.

h. Space Requirements.

<i>Line capacity</i>	<i>Switch-board positions</i>	<i>Space requirements—square feet</i>
C. B. Manual Telephone Switch-board (Fixed Plant):		
100-----	1	250
100-----	2	275
200-----	2	300
200-----	4	500
600-----	10	1,380
800-----	11	1,520
1,000-----	14	1,900
1,200-----	16	2,280
1,600-----	22	2,764
2,000-----	27	3,400
2,800-----	40	4,760

Fixed communication center:

Small -----	950
Medium -----	1,900
Large -----	3,000

Fixed radio transmitter station:

Small -----	2,300
Medium -----	4,425
Large -----	5,500

Fixed radio receiver station:

Small -----	1,550
Medium -----	3,600
Large -----	4,450

Antenna field:*

Transmitter:

	<i>Acres</i>
Small (2-6 antennas) -----	6 to 30
Medium (9 antennas) -----	35 to 100
Large (20 antennas) -----	100 to 400

Receiver:

Small (2 antennas) -----	6
Medium (20 antennas) -----	100 to 300
Large (35 antennas) -----	200 to 600

Section III. MAINTENANCE

8.14. Vehicle Losses*

Estimated daily losses in frontline divisions of general-purpose vehicles destroyed and

evacuated, number per 1,000 of actual vehicle strength:

	1	2	3	4
	General type of operations for the force as a whole	Destroyed	Require repair by unit maintenance section ¹	Require field or depot maintenance
1				
2	Infantry division in attack of fortified position-----	27	27	15
3	Infantry division in attack of deliberately organized position-----	16	15	11
4	Infantry division in attack of hastily organized position-----	10	10	9
5	Infantry division in covering, security force, retirement, or delaying action-----	5	5	7
6	Infantry division in defense of position-----	9	7	7
7	Infantry division in inactive situation ² -----	3	2	6
8	Infantry division in pursuit-----	5	5	7
9	Infantry division in assault of hostile shore-----	27	30	20
10	Infantry division in reserve-----	Negligible	³ 2	³ 1
11	Armored division in attack-----	16	15	11
12	Armored division in inactive situation ² -----	3	2	6
13	Armored division in pursuit or exploitation-----	5	8	10
14	Armored division in retirement or delaying action-----	5	5	7
15	Armored division in reserve-----	Negligible	³ 2	³ 1

¹ These quantities are in addition to the number in unit maintenance section each day for scheduled servicing.

² Forces in contact, neither side attacking.

³ These figures do not apply during rehabilitation.

* Detailed information is contained in DA SB 9-101 and 9-107.

* Space is based on average conditions existing; however, depending on type antennas, equipment used, location, and terrain, space requirements may vary.

CHAPTER 9

LOGISTICS—MANAGEMENT

Section I. GENERAL

9.1. Introduction

Preceding chapters on logistics have presented detailed data applicable to all branches of logistical planning. This chapter summarizes these data in the form of general logistical planning factors that will be found useful to staff officers at higher levels. It should be noted that these factors apply to *average* conditions

and situations. They should be used only as a first approximation in logistical planning or as “rule of thumb” checks against the calculations of technical planners. Specific situations may require widely different factors.

9.2. Organizational Factors—Theater Slices

a. Division Slices.

Composition of slice by assignment of troops		Percentage of slice		Composition of slice by location of troops	
Assignment	Troops	Theater	Combat zone	Troops	Location
Basic division.....	13,960	32	43	20,000	Division area.
Corps and army troops.....	18,540	43	57	12,500	Corps and army rear areas.
Communications zone and theater overhead.....	10,750	25	-----	10,750	Communications zone.
Total.....	43,250	100	100	43,250	

b. Air Wing Slices.

Composition of slice by assignment of troops		Percentage of slice		Composition of slice by location of troops	
Air Force combat organization.....	2,550	36	-----		Division area.
Miscellaneous Air Force support units.....	3,450	50	-----		Corps and army rear areas.
Army communications zone troops*	1,000	14	7,000		Communications zone.
Total.....	7,000	100	7,000		

* Army troops required within the theater because of the presence of Air Force elements, which are provided Army administrative support.

c. *Figures on Slices.* Detailed figures on slices appear in paragraphs 4.1 through 4.7.

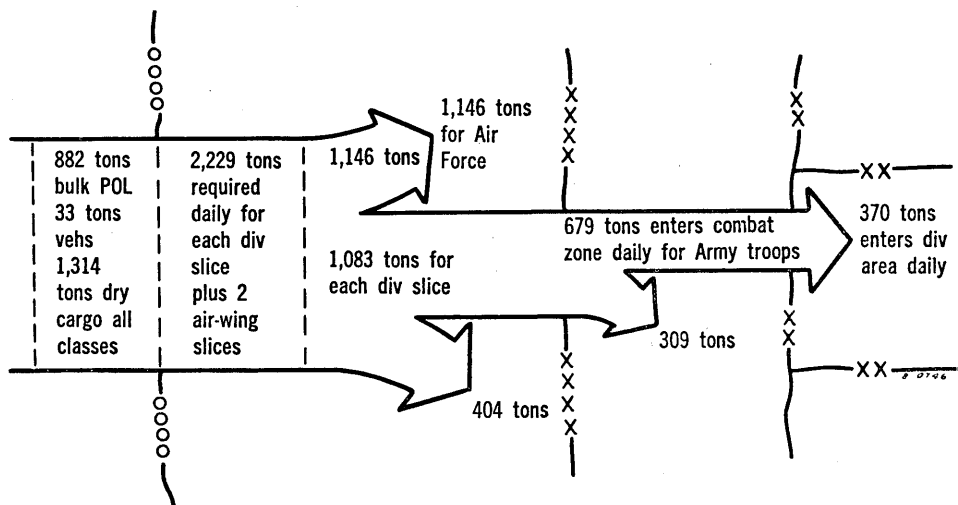
Section II. LOGISTICAL FACTORS

9.3. Supply Factors

These factors are for use as broad initial planning factors. They do not include tonnages

involved in buildup of theater reserves.

a. Maintenance, short tons per day, for each division slice plus two airwing slices.



b. Maintenance, Pounds Per Man Per Day.

	Consumed per man in theater (Army plus Air)	Consumed by Army in theater, per Army man in theater	Consumed by Army in combat zone, per Army man in combat zone	Consumed by Army in division areas, per Army man in such areas
Bulk POL.....	31	10	10	5
Vehicles.....	1(—)	1(—)	1	1(+)
Dry cargo.....	46	39	31	31(—)
Total.....	78	50(—)	42	37

c. Initial equipment Plus 30 Days' Maintenance.

	Measurement tons per man in the theater (Army plus Air)	Short tons per man in the theater (Army plus Air)	Long tons per man in the theater (Army plus Air)
Initial equipment.....	4.0	1.50	1.33
30 days' maintenance dry cargo.....	¹ 1.0	.68	.60
30 days' maintenance bulk POL.....	² .43	.30	.26
Total.....	5.43	2.48	2.19

¹ In World War II, 0.8 of this figure was shipped from zone of interior and remainder procured locally.

² Bulk petroleum normally is not expressed in measurement tons. This figure is provided for the purpose of comparison with dry cargo. Bulk petroleum represents 90 percent of all petroleum shipped to the theater. The remaining 10 percent is shipped packaged and is included in dry cargo.

9.4. Evacuation and Hospitalization Factors

Kind of hospitalization	Quantity required
Mobile hospital units:	
Evac, smbl.....	1 per div and 2 per corps.
Field.....	1 per div and 1 per corps.
Fixed-hospital beds in the theater of operations (general and station hospitals).	7 percent of theater of operations strength.

9.5. Transportation Factors

a. Capacities of Transportation Mediums.

Mediums		Short tons per day	Long tons per day	Adequate to maintain
Highways (average)-----	Gravel-----	1,000	890	2 divisions.
	Medium condition-----	2,500	2,230	Corps of 4 divisions.
	First class-----	8,000	7,140	Field army of 8-12 divisions.
Railways each way-----	Single track-----	4,000	3,570	2 corps totaling 5-8 divisions.
	Double track-----	12,000	10,700	Field army of 12-18 divisions.
Pipeline-----	4-in. (inside dia)-----	910	810	1 corps of 4 divisions.
	6-in-----	2,000	1,800	2 corps of 8 divisions.
	8-in-----	3,480	3,100	1 type field army.
	12-in-----	18,300	16,430	5 type field armies.
Discharge rate-----	Average cargo ship-----	720	633	
Across beaches-----	Per 1,000 yards of beach-----	1,680	1,500	
Capacities of average cargo ship-----		10,000 measurement tons or 5,000 long tons of Army cargo.*		
Capacities of average train in theater of operations-----		1,000 troops or 400 short tons of cargo.		

* See paragraph 7.49n.

b. Transportation Requirements of the Infantry Division (ROCID).

Type	Requirement		
Highway-----	5 trans light trk companies in addition to organic transport.		
Air-----	Approximately 862 C-119 or C-123 type aircraft and 695 C-124 type aircraft are required to airland an infantry division. In addition to weapons and essential vehicles (less tanks), this combination provides for the lift of 275 tons of supplies and miscellaneous equipment.		
Amphibious assault---	Average strength of an <i>assault division</i> , including shore party and other attached and supporting elements, is 25,000 men with 5,000 vehicles. If 75 percent of the vehicles of the infantry division and attached and supporting elements are loaded out with the division in assault shipping, the requirements in assault shipping for reinforced division in an amphibious assault are:		
	Type	Extended voyage (10 days)	Short voyage (2-3 days)
	APA (auxiliary transport, attack)-----	10	1
	AKA (cargo ship, attack)-----	2	2
	LST (landing ship, tank)-----	25	50
	LSD (landing ship, dock)-----	7	7
	CVAH (aircraft carrier, assault, helicopter)-----	6	6

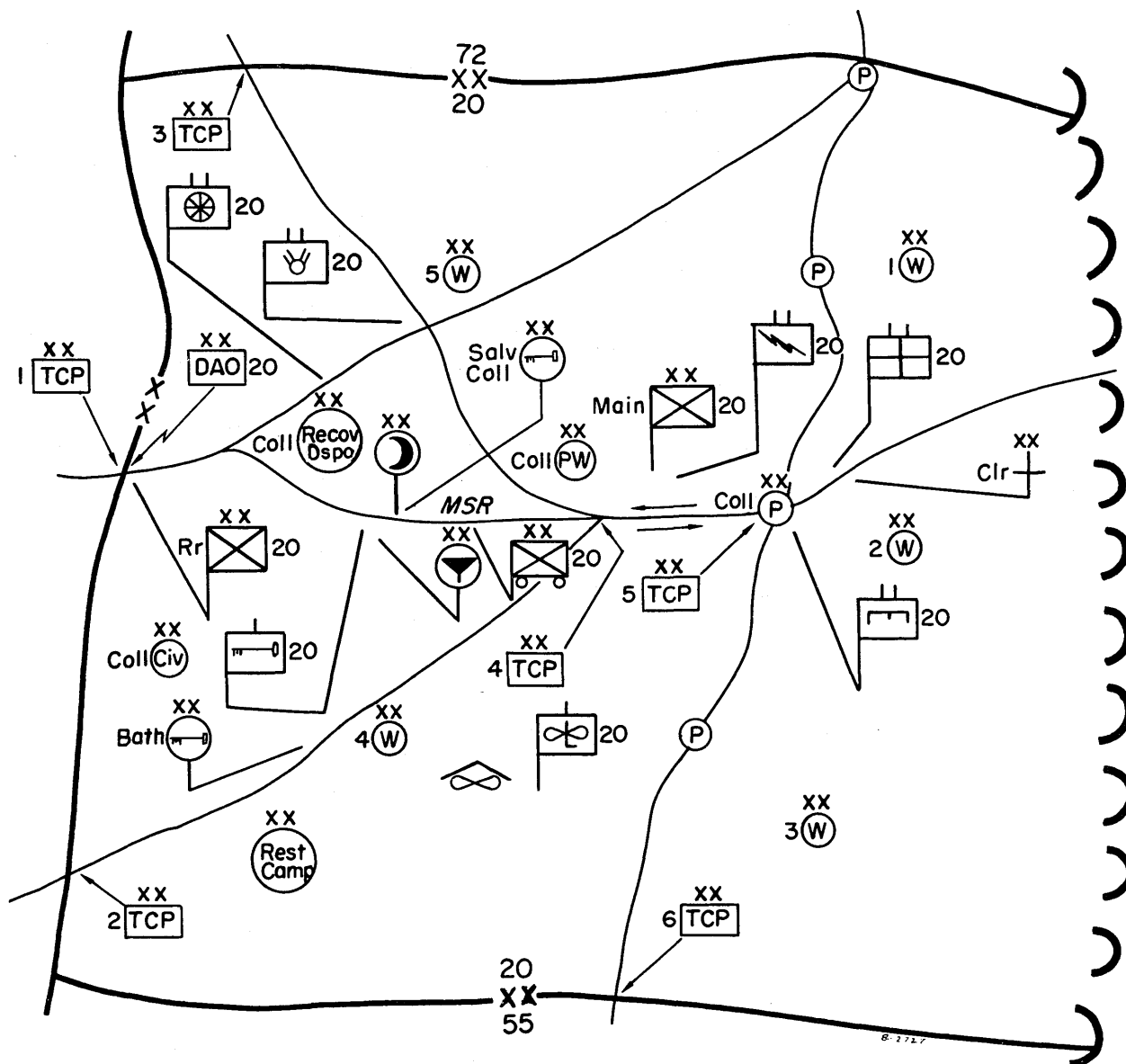
9.6. Service Factors

a. *Service Troop Factors.* Service troops equal approximately 40 percent of division slice; 60 percent of service units are in com-

munication zone, 40 percent in combat zone.

b. *Equipment Factors.* One vehicle for 5 to 6 men in a balanced force.

9.7. Infantry Division Administrative Installations (Schematic)



- Notes:
1. Location of the division trains area is a responsibility of the G4.
 2. Division headquarters rear command post may be located outside the division area.
 3. The disposition of any element may be modified from that shown to fit the terrain and/or the tactical situation.

9.8. Legal Services

Past experiences indicate the following workloads may be expected in oversea theaters in times of hostilities.

a. Workload Per 10,000 Men.

Area of responsibility	GCMs/mo	Claims/mo	War crimes incidents/mo	Legal assistance matters/mo
Combat zone-----	¹ 2 6	³ 25	⁴ 15	30-50
Communicationszone-	¹ 2 9	³ 150	⁴ 10	100-150

¹ The incidence of general courts-martial may vary as much as 100 percent above the average stated without being considered abnormal.

² It may be expected that for each general court-martial in a command there will be 7.7 special courts-martial and 12.7 summary courts-martial.

³ The rate of claims resulting from the presence of a given number of troops in a theater will depend upon whether the area is industrialized or rural and upon the population density of the area. These rates are appropriate for planning operations in Europe.

⁴ Although the enemy troop strength would be the source of the war crimes, for planning purposes our strength may be assumed to vary as the enemy strength varies.

b. Judge Advocate Teams. These teams may be employed to augment organic judge advocate sections when needed.

Unit	Work unit/month
Claims investigating team BA-----	75-100 claims
War crimes investigating team CA----	10-15 incidents
GCM trial team BA-----	10-15 GCM*
GCM trial team DB-----	20-25 GCM*
Legal assistance team EA-----	100-150 cases

* This figure comprehends trial only, administrative details being handled by organic staff sections.

CHAPTER 10

MISCELLANEOUS

Section I. CONVERSION FACTORS

10.1. Weight

	1	2	3	4	5	6
1	Unit	Long tons	Metric tons	Short tons	Kilograms	Pounds
2	1 long ton = -----		1.0160	1.1200	1,016	2,240
3	1 metric ton = -----	0.9842		1.1023	1,000	2,204.6
4	1 short ton = -----	.8929	.9072		907.2	2,000
5	1 kilogram = -----					2.2046

10.2. Speed

	1	2	3	4	5	6	7	8
1	Unit	Knots	Statute miles per hour	Kilometers per hour	Feet per minute	Feet per second	Meters per minute	Meters per second
2	1 knot* = -----		1.1516	1.8532	101.34	1.6890	30.89	0.5148
3	1 mile per hr = -----	0.8684		1.6093	88.00	1.4667	26.82	.4470
4	1 km per hr = -----	.5396	.6214		54.68	.9113	16.67	.2778

* 1 knot = 1 nautical mile per hour.

10.3. Power

	1	2	3	4	5	6
1	Unit	Kilowatts	Horse-power	Btu* per min	Ft lb per sec	Ft lb per min
2	1 kilowatt = -----		1.3410	56.88	737.6	44,250
3	1 horsepower = -----	0.7457		42.42	550.0	33,000
4	1 Btu* per min -----	.01758	.02358		12.968	778.1

* 1 Btu, or British thermal unit, is the quantity of heat required to raise the temperature of 1 pound of water 1° Fahrenheit.

10.4. Angular Conversions

	1	2	3	4	5
1	Unit	Radians	Degrees	Mils	Minutes
2	1 radian = -----		57.30	1,018.6	
3	1 degree = -----	0.17453		17.778	60
4	1 mil = -----		.05625		3.375

Note. $360^\circ = 2\pi$ radians = 6,400 mils.

10.5. Linear Measure

	1	2	3	4	5	6	7	8	9	10	11
	Unit	Nautical miles	Statute miles	Kilo-meters	Cable lengths	Fathoms	Meters	Yards	Feet	Inches	Centimeters
2	1 nautical mile = -----	-----	1.1516	1.8532	8.445	1,013.4	1,853.2	2,026.8	6,080.27	72,963	185,325
3	1 statute mile = -----	0.8684	-----	1.6093	7.333	880	1,609.3	1,760	5,280	63,360	160,933
4	1 kilometer = -----	.5396	.6214	-----	4.557	546.8	1,000.0	1,093.6	3,281	39,370	100,000
5	1 cable length = -----	.1184	.1364	.2195	-----	120	219.5	240	720	8,640	21,945
6	1 fathom = -----	-----	-----	-----	-----	-----	1.829	2	6	72	182.88
7	1 meter = -----	-----	-----	-----	-----	.5468	-----	1.0936	3.281	39.37	100
8	1 yard = -----	-----	-----	-----	-----	.5000	.9144	-----	3	36	91.44
9	1 foot = -----	-----	-----	-----	-----	.1667	.3048	.3333	-----	12	30.48
10	1 inch = -----	-----	-----	-----	-----	-----	-----	-----	.0833	-----	2.540
11	1 centimeter = -----	-----	-----	-----	-----	-----	-----	-----	.0328	.3937	-----

10.6. Surface

	1	2	3	4	5	6	7	8	9
	Unit	Square miles	Square kilometers	Hectares	Acres	Square rods	Square meters	Square yards	Square feet
2	1 square mile = -----	-----	2.59	259	640	102,400	2,589,945	3,097,600	-----
3	1 square kilometer = ---	0.3861	-----	100	247.1	39,537	1,000,000	1,196,010	-----
4	1 hectare = -----	-----	.0100	-----	2.471	395.4	10,000	11,960	107,641
5	1 acre = -----	-----	-----	.4047	-----	160	4,047	4,840	43,560
6	1 square rod = -----	-----	-----	-----	-----	-----	25.29	30.25	272.25
7	1 square meter = -----	-----	-----	-----	-----	.03954	-----	1.1960	10.764
8	1 square yard = -----	-----	-----	-----	-----	.03306	.8361	-----	9.000

10.7. Volume

	1	2	3	4	5	6
1	Units	Cubic feet	Imperial gallons	US gallons	Liters	Quarts
2	Cubic foot = -----	-----	6.229	7.481	28.32	29.92
3	1 imperial gallon = -----	0.16054	-----	1.2010	4.546	4.804
4	1 US gallon = -----	.13368	.8327	-----	3.785	4.000
5	1 liter = -----	.03532	.2201	.2642	-----	1.0567
6	1 measurement ton = -----	40.	-----	-----	-----	-----
7	1 barrel (petroleum) = -----	5.61	-----	42.0	-----	-----

Section II. PHYSICAL CONSTANTS

10.8. Speed of Sound

	1	2	3	4	5	6	7	8
1	Unit	In air (at degrees F)					In water	
		10°	0°	30°	70°	100°	Fresh	Salt
2	Feet per sec = -----	1,039	1,050	1,083	1,127	1,171	4,700	4,752
3	Miles per hr = -----	708	716	738	768	797	3,205	3,246

10.9. Speed of Light

The speed of light is approximately 186,000 miles per second.

10.10. Acceleration Due to Gravity

Acceleration due to gravity is 32.2 feet per second per second.

10.11. Atmospheric Pressure

Atmospheric pressure is 14.7 pounds per square inch. This is equal to the pressure

exerted by a column of water 33.9 feet high, which is the theoretical maximum height to which water may be drawn by suction.

10.12. Circumference of the Earth at the Equator

The circumference of the earth at the equator is 24,902 miles.

10.13. Time Between Moons

Time between moons is 29 days, 12 hours, 44 minutes.

APPENDIX

REFERENCES

FM 3-5	Chemical, Biological, and Radiological (CBR) Warfare.
FM 3-8	Chemical Corps Reference Handbook.
FM 5-10	Routes of Communications.
FM 5-15	Field Fortifications.
FM 5-35	Engineers' Reference and Logistical Data.
FM 5-36	Route Reconnaissance and Classification.
FM 6-61A	Field Artillery Battalion, 762-mm Rocket.
FM 7-24	Communication in Infantry and Airborne Divisions.
FM 9-6	Ordnance Ammunition Service in the Field.
FM 11-16	Signal Orders, Records, and Reports.
FM 11-17	Tactical Communications Center Operation.
FM 11-20	Organizations and Operations in the Corps, Army, Theater of Operations, and GHQ.
FM 11-22	Signal Operations in the Corps and Army.
FM 11-40	Signal Photography.
FM 11-51	Signal Air Photo Reproduction and Delivery Company (TOE 11-54 ()).
FM 17-70	Signal Communication in the Armored Division.
FM 19-40	Handling Prisoners of War.
FM 20-32	Employment of Land Mines.
FM 21-5	Military Training.
FM 21-6	Techniques of Military Instruction.
FM 21-26	Map Reading.
FM 21-30	Military Symbols.
FM 24-18	Field Radio Techniques.
FM 24-20	Field-wire Techniques.
FM 30-5	Combat Intelligence.
FM 31-10	Barriers and Denial Operations.
FM 55-51	Transportation Terminal Commands, Theater of Operations.
FM 55-52	Transportation Terminal Battalion and Terminal Service Company.
FM 55-53	Transportation Amphibious Truck Company.
FM 55-110	Transportation Port Companies Military Stevedoring.
FM 57-20	Airborne Techniques for Divisional Units.
FM 57-30	Airborne Operations.
FM 60-30	Amphibious Operations; Embarkation and Ship Loading (Unit Loading Officer).
FM 100-5	Field Service Regulations; Operations.
FM 100-10	Field Service Regulations; Administration.
FM 100-11	Signal Communications Doctrine.
FM 101-1	The G1 Manual.
FM 101-5	Staff Officers' Field Manual; Staff Organization and Procedure.
FM 105-5	Maneuver Control.
FM 110-5	Joint Action; Armed Forces.
TT 7-100-2	The Infantry Division.
TT 57-100-30	The Airborne Division and Airborne Operations.
TM 3-200	Capabilities and Employment of Toxic Chemicals.
TM 5-231	Mapping Functions of the Corps of Engineers.
TM 5-236-1	American Ephemeris and Nautical Almanac, 1957.

TM 5-240	A Guide to the Compilation and Revision of Maps.
TM 5-245	Map Reproduction.
TM 5-248	Foreign Maps.
TM 5-260	Principles of Bridging.
TM 5-277	Panel Bridge, Bailey Type, M2.
TM 5-280	Construction in the Theater of Operations.
TM 5-285	Semipermanent Highway Steel Bridges 30-, 60-, and 90-foot Spans.
TM 5-286	Semipermanent Highway and Railway Trestle Bridges.
TM 5-350	Military Pipeline Systems.
TM 5-372	Unit Construction Railway Bridge.
TM 5-374	Light Standard and Standard Unit Steel Trestles.
TM 5-1172	Crane, Crawler-mounted, Gasoline, $\frac{3}{4}$ Cu Yd, with Attachments, Koehring Model 304 with Chrysler Engine Modifications.
TM 5-5065	Compressor, Air, Truck-mounted, Gasoline-driven, 210 CFM, LeRoi Model 210G1.
TM 5-9060	Crane, Tractor, 20-ton, 20-ft Boom, LeTourneau Model M20.
TM 5-9132	Auger, Earth, Skid-mounted, Gasoline, Highway Trailer Model HDM-S with Continental Engine, Model PF-226.
TM 5-9861-1	Crane-shovel Power Unit, Revolving, Crawler-mounted, Diesel-driven, 30 to 40 Tons, 2 Cu Yd, Vacuum-controlled, Lima, Model 802 with Attachments (Less Engine).
TM 9-710	Half-track Vehicles; Car M2A1, Personnel Carrier M3 and M3A1, 81-mm Mortar Carrier M4, M4A1, and M21 Combination Gun Motor Carriage M15A1 and Multiple Gun Motor Carriage M16 and M16A1.
TM 9-717	105-mm Howitzer Motor Carriage M37.
TM 9-7204	Operation and Organizational Maintenance: 105-mm full tracked self-propelled Howitzer M52 (T98E1).
TM 9-729	Light Tank M24.
TM 9-744	155-mm Howitzer Motor Carriage M41.
TM 9-747	155-mm Gun Motor Carriage M40 and 8-inch Howitzer Motor Carriage M43.
TM 9-761	Twin 40-mm Gun, Motor Carriage M19A1.
TM 9-1900	Ammunition, General.
TM 9-1901	Artillery Ammunition.
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TM 9-1940	Land Mines.
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TM 9-7212	155-mm Full-tracked Self-propelled Gun M53 (T97).
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TM 10-1619	Quartermaster Materials Handling Equipment.
TM 30-246	Tactical Interpretation of Air Photos.
TM 57-210	Air Movement of Troops and Equipment.
TM 57-210A	Air Movement of Troops and Equipment. (U)
TB AVN 2	Recommended and Alternate Grade Fuels, Engine and Transmission Oils for Army Aircraft-engine Combinations.
TB ENG 56	Requisitions for Stockpile Railway Bridges and Trestles.
AR 10-5	Department of the Army.
AR 11-8	Logistics Policies and Priorities.

AR 55-21	General Passenger Traffic Procedures Applicable to Procurement of Transportation and Accommodations.
AR 55-355	Military Traffic Management Regulation.
AR 117-5	Mapping and Surveying.
AR 220-50	Regiments; General Provisions.
AR 220-60	Battalions—Battle Groups—Squadrons—General Provisions.
AR 220-70	Companies; General Provisions.
AR 230-5	General Policies.
AR 320-50	Authorized Abbreviations and Brevity Codes.
AR 385-63	Regulations for Firing Ammunition for Training, Target Practice, and Combat.
AR 700-12	Control, Supply, and Positioning of Materiel.
AR 701-9100-1	Petroleum Supply System.
AR 785-10	Acquisition, Expansion, Utilization, and Allocation of Supply and Storage Space.
SR 210-20-20	Training Areas and Facilities for Ground Troops.
SR 320-5-1	Dictionary of United States Army Terms.
DA Pam 108-1	Index of Army Motion Pictures, Film Strips, Slides, and Phono-recordings.
DA Pam 310-1	Index of Administrative Publications.
DA Pam 310-2	Index of Blank Forms.
DA Pam 310-3	Index of Training Publications.
DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.
DA Pam 310-5	Index of Graphic Training Aids and Devices.
DA Pam 310-7	Index of Tables of Organization and Equipment, Table of Organization, Type Tables of Distribution, and Tables of Allowances.
DA Pam 310-21	Index of Supply Manuals; Signal Corps.
DA Pam 310-22	Index of Supply Manuals; Transportation Corps.
DA Pam 310-23	Index of Supply Manuals; Chemical Corps.
DA Pam 310-25	Index of Supply Manuals; Corps of Engineers.
DA Pam 310-29	Index of Supply Manuals; Ordnance Corps.
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By Order of *Wilber M. Brucker*, Secretary of the Army:

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USAIS (2000)
TJAGSA (5)
AMSS (888)
USA Ord Sch (15)
USAOGMS (150)
PMGS (450)
USA QM Sch (800)
USA Sec Agcy Sch (100)
USASCS (660)
USASWS (50)
USATSCH (500)
USAINTC (300)
PMST Sr Div Units (2)
PMST Jr Div Units (2)
PMST Mil Sch Div Units (2)
Gen Depots (5)
Sup Sec, Gen Depots (5)
Depots (5)
AH (2)
PG (2) expect
USA Elct PG (100)
Trans Terminal Comd (2)
Arsenals (1)
Mil Dist (1)
USA Corps (Res) (1)
Sector Comd, USA Corps (Res) (1)
MAAG (2)
Mil Mis (1)

NG: State AG (3); Div (5); Brig (5); Regt/Gp (3); Bn (1).

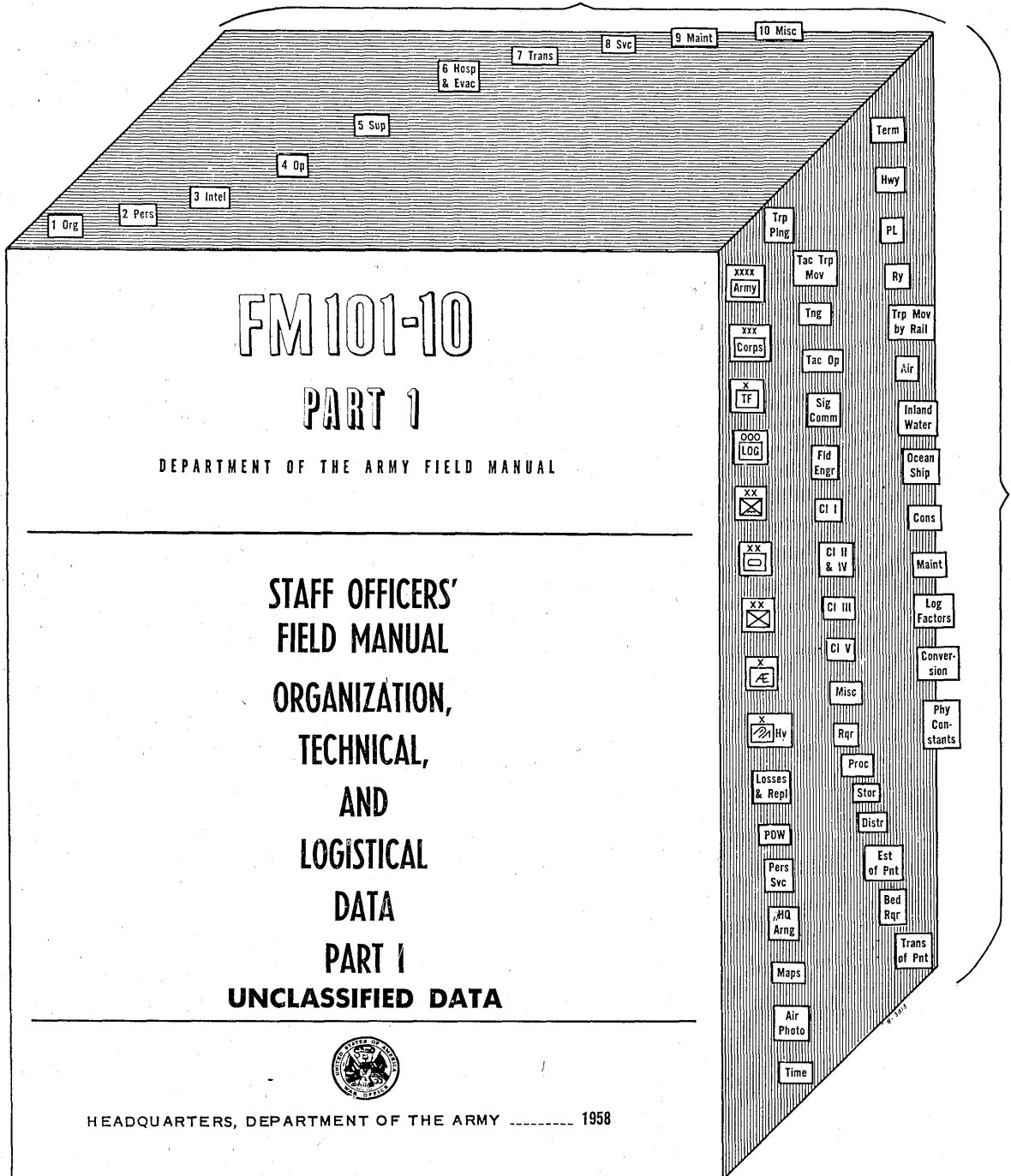
USAR: Same as Active Army except allowance is one copy to each unit.

For explanation of abbreviations used, see AR 320-50.

☆ U. S. GOVERNMENT PRINTING OFFICE: 1959-400507

SUGGESTED METHOD OF PLACING INDEX TABS

Place Chapter Number Tabs on Top of Manual



Chapter number and abbreviated title appear at the top of the page and are attached to the first page of the chapter. (Chapter separators of cover stock may be inserted between chapters if desired.) Abbreviated section titles within a chapter appear at the side of the manual and are attached to the page on which the particular section begins.